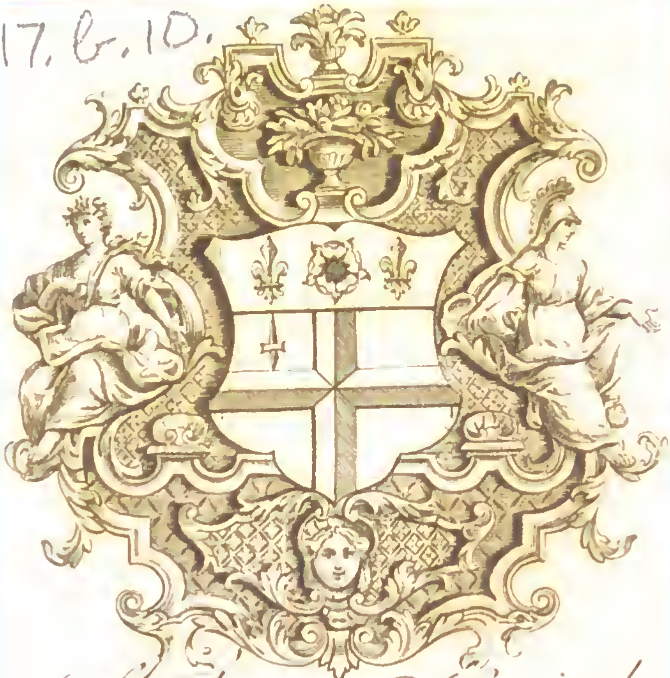

OUTLINES

OF THE

ANATOMY

OF THE

HUMAN BODY,

IN ITS SOUND AND DISEASED STATE,

BY

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TO

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WHOSE IMPORTANT PRACTICAL OBSERVATIONS

AND DISCOVERIES

RESPECTING A NEW MODE OF

OBTAINING AND PRESERVING THE INFECTION

OF THE COW POX,

AND A CERTAIN TEST OF PERFECT VACCINATION,

HAVE PROVED SO BENEFICIAL

TO MANKIND,

THIS VOLUME

IS DEDICATED

BY

HIS SINCERE FRIEND,

THE AUTHOR.

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OUTLINES

OF THE

ANATOMY OF THE HUMAN BODY.

CHAPTER I.

GENERAL OBSERVATIONS UPON THE STRUCTURE AND FUNCTIONS OF THE ORGANS OF DIGESTION.

BY *Digestion*, is understood that process, by which the food received into the alimentary canal undergoes the alteration necessary for repairing the waste, and sustaining the strength of the animal during the exercise of its several functions.

To support the strength of the body, animals are provided with digestive organs; and are at

the same time stimulated, by the sensations of hunger and thirst, to take in the proper supply of aliment.

The food is separated into its useful and useless parts within the stomach and intestines; and the nutritious part, called Chyle, is absorbed by small vessels, which, from the colour of the fluid they contain, have been called *Lacteal.*

It is the office of these vessels to convey the lacteal fluid to be mixed with the blood, the source from which every part of the body is formed and nourished.

In considering the nature of digestion, it is necessary to examine,

1. The preparation which the food undergoes before it enters the stomach.

2. The changes it undergoes in the stomach and intestines.

3. The separation of the nutritious and excrementitious parts.

4. The mode of conveyance of the nutrition or chyle into the blood.

5. The changes which it undergoes after its mixture with the general circulating fluid.

6. The nature of the secreted fluids, and the effects of the different secretory and excretory organs.

Such an extensive view of the subject, beside unfolding the anatomical structure and particular use of the different organs, is calculated to exhibit an instructive physiological view of the relations established between them, and of the subserviency of all the functions of the animal economy to one another.

Animals receive their food into an *internal receptacle, or stomach, situated within the body.* Vegetables are nourished by their roots, and *by the vessels which open upon their surfaces.* HIPPOCRATES has justly remarked, 'Ut terræ arboribus, 'ita animalibus ventriculus.'

A relation is established between the external form of an animal, and its organs of sensation, mastication, and digestion. Hence the remarkable differences in the external form, and internal organization of carnivorous, graminivorous, and omnivorous animals or those that feed alike upon animal and vegetable food.

The shape and movements of the human jaw; the structure and form of the human teeth; the organization, length, and convolutions of the alimentary canal,—all clearly shew that man is intended to be *omnivorous*, or to live both on vegetable and animal food.

The length, diameter, and structure of the coats of the *alimentary canal*, and the manner in which the different parts of that canal communicate

with one another, which is more or less favourable to the exit or detention of the food, are by no means the same in different animals, and bear a relation to the kind of food. Thus, *the alimentary canal* of a graminivorous animal is not only much longer, and more complicated in its structure, but also much more capacious than that of a carnivorous animal, whose food contains more nourishment in smaller compass, and is more readily digested.

The alimentary canal of an animal designed to live partly on vegetable, and partly on animal food, holds a middle place between that of a carnivorous and graminivorous animal. In this class, *man is included ;* and, when the individual reaches to maturity, the alimentary canal is generally between thirty and thirty-six feet long.

In the lower classes of animals, the *Alimentary Canal* is of a very simple structure, consisting chiefly or solely of a bag, into which the food is received, and of an aperture through which it is discharged. But, in the higher classes of animals, it is more complex in its form and apparatus, being of considerable length, and enlarged in one or more places, to constitute a *stomach* or *stomachs ;* and in such animals, the term *Gullet* is applied to the canal which leads into the stomach, and the term *Intestine*, to that which leads out from the stomach, and through which the food is conveyed out of the body.

Before the food reaches the stomach, it is minutely divided by the teeth, mixed with the saliva and mucus of the mouth and throat; and it is then carried, by means of the muscular power of the gullet, into the stomach.

The food, owing to the particular figure, position, and structure of the orifices of the human stomach, is retained within that organ, to undergo the first process of digestion.

Some authors have asserted, that the food is completely digested within the stomach by means of the *Gastric Juice.* But in my opinion this assertion is not well founded, nor do I think the process of digestion can be considered as complete, until the aliment has been mixed with the bile, pancreatic juice, and other animal secretions, in its long circuitous route through the intestines, by which its nature is completely changed, or its assimilation perfected.

The *Chyle* or nutritious part, the product of digestion, is afterwards in all probability somewhat changed in its properties during its passage through the lacteal vessels; but it is not completely animalized until after its admixture with the blood, and until it has been exposed in its passage through the lungs to the influence of the atmospherical air.

The *Human Intestinal Canal* is about six times the length of the body, in order that the food may undergo the necessary changes, and it is divided in-

to two portions of very unequal size, both of which have their length greatly increased by various convolutions.

The internal surface of the Intestinal Canal is much more extensive than the external, the inner coats being folded into doublings, which, performing in some measure the office of *Valves*, have been named by anatomists *Valvulæ Conniventes;* and the inner surface is still further extended by the subdivisions of these Valvulæ into very small Villi.

By the above means, the internal surface of the intestines is much extended: more space is given for the absorption of the nutritious part of the aliment, and the addition of those secreted fluids which probably have a chemical effect upon our food, and also for the addition of the mucus which defends the intestines from the acrimony of its contents.

The food is carried through this long and circuitous route by a series of powerful muscular fibres, which constitute the coats of the alimentary canal; and these coats perform their office so completely, as to propel the contents of the intestines contrary to their gravity, and even to push forward air or quicksilver.

To this effect the muscles of the parietes of the belly, and that muscle between the belly and chest called diaphragm, essentially contribute.

The muscular coats also produce the peristaltic and antiperistaltic motion, which is kept up by the stimulus of the food. Thus the various contents of the alimentary canal are intimately united; some are dissolved; others enter into new combinations; and thus also the alimentary mass is presented to the lacteal vessels, which take their origin from the inner surface of the intestines; and the discharge of that part of our food which is useless is accomplished. But as, without the addition of some other covering, the muscular coats of the alimentary canal would be exposed to be torn; therefore the membrane called Peritonæum, which fixes the alimentary canal to the back-bone, is continued over the stomach and intestines, forming their external covering, by means of which the alimentary canal is enabled to resist over-distention from air or fæces.

There is still another property, which is indispensably necessary to the alimentary canal, viz. a power of accommodating its capacity to the quantity of its contents. This is provided for by the elasticity and expansive power of all the coats, owing to the introduction of a quantity of loose cellular substance between the muscular and villous coats, and also to the loose manner in which the stomach and intestines are fixed to the body.

Lest the alimentary canal should be injured by the acrimony of its contents, and in order to facilitate the passage of these, the innermost coat, called, from its resemblance to velvet, *villous*, is moistened and besmeared by a considerable quantity of a mucous fluid, which is derived from a number of glands, imbedded in the cellular substance uniting the muscular and villous coats.

CHAPTER II.

OF THE ORGANS OF MANDUCATION AND DEGLUTITION.

Sect. I.

OF THE JAWS AND TEETH.

The jaws and teeth are the organs of manducation.

The size, form, and strength of the jaws, and the structure and number of the teeth, are very different in different animals, being adapted to the kind of food on which the animal is intended to live.

The structure and movements of the jaws have been explained in the preceding volume; and therefore I proceed to describe the Teeth.

In the adult there are sixteen teeth in each jaw; in all thirty-two; but sometimes only thirty. The teeth of the upper jaw are placed nearly perpendicularly in respect to the skull, whereas those of the under jaw incline inwards.

The periosteum only covers the roots of the teeth, otherwise it must have been liable to be bruised during manducation.

Each tooth consists of a body and of one or more roots; and between these there is a contracted portion, which has been called the neck or collar of the tooth.

The roots of the teeth are implanted within the alveolar processes of the jaws, which are spongy bones, in the same manner as a nail is inserted into a piece of wood; or they are fixed into the jaw by what anatomists call *gomphosis*.

The sponginess of the jaw prevents the teeth from being readily broken during manducation. The roots of the teeth are fixed to the alveolar processes by the periosteum, which lines the sockets, and is reflected upon the roots of the teeth, as far as the collar of the tooth, where it is attached to the gums.

The length of the roots of different teeth is various; those of the dog teeth are the longest in

the human body, and next to them those of the front teeth of the upper jaw.

The roots of the grinding teeth are the shortest, and diverge at a considerable angle from the body of the tooth. The smaller grinders of the upper jaw have three roots. The larger four; but these, from the vicinity of the antrum maxillare, are necessarily shorter than those of the under jaw. The roots are somewhat of a conical figure: thus the pressure falls upon the sides, and not upon the apex of the bone, where the bloodvessels and nerves enter the tooth.

The roots of the grinding teeth diverge from each other: hence the body of these teeth is supported in part by the alveolar process, and the pressure divided during manducation.

The neck or collar is grasped by the socket, and also by the gum; and when this has been destroyed by scurvy, salivation, or other causes, the teeth frequently fall out.

That part of the teeth above the gum, is covered by a very hard, white, fibrous and insensible substance, called *Enamel*, which becomes gradually thinner towards the neck of the tooth. The enamel is not of an uniform thickness in different teeth, nor in every part of the same tooth. It is thicker towards the upper surface, than in other parts of the tooth.

The fibres of the enamel are very small, and parallel to each other, and perpendicular to the

surface of the tooth, not only on the flat part of the tooth, but also on the sides of the base. By such an arrangement of the fibres of the enamel, it is not apt to scale off; and therefore is well calculated to resist attrition.

The enamel contains, according to the experiments of Mr Pepys, 78 *parts of phosphate of lime, and* 6 *of carbonate of lime, in the* 100. It is almost entirely soluble in acids; and retains its white colour, though exposed to a considerable degree of heat. The enamel forms only a crust for the teeth in man, and carnivorous animals; but, in the ruminant animal, it dips into the body of the tooth, and, being much harder, than the osseous part, it is not so quickly worn down; and therefore the tooth is always kept sharp, and fit for use.

The roots of the teeth are covered by a thin layer of yellow matter, which has been called *horny substance.*

Every tooth has a smooth, internal cavity, of the same shape as the body of the tooth, which is filled by a substance called Pulp. There is a small aperture near the point of each root, which leads into the cavity of the tooth, through which the bloodvessels and nerves enter into the substance of the tooth.

The bony * matter of the teeth, which is harder than that of most other bones, consists of a number of layers, parallel to the pulp, and to each other; and, according to Mr PEPYS, consists of 58 parts in the 100 of phosphate of lime, of 4 of carbonate of lime, of jelly 28; and the water of composition and loss, amounted to 10. §

The teeth are amply furnished with *Bloodvessels*, which may be filled with a colouring liquor, and, if divided, pour out blood, as the teeth are sawn across by the dentist.

As a further proof of the vascularity of the teeth, Nodes sometimes form on them; and the roots are sometimes joined together by Anchylosis.

The teeth have also *Lymphatic Vessels*.

Though the *Lymphatic Vessels* of the teeth cannot be demonstrated, there are various facts which prove their existence, viz. the absorption of the roots of the first set of teeth, the colour given to the osseous part of the teeth by madder, being removed after discontinuing the use of it, and the swelling of the lymphatic glands from a carious tooth.

* EYSSON † and CUVIER ‡ affirm, that the bony part of the tooth differs from common bone in its structure and manner of formation; and that it resembles common bone only in hardness, and in its constituent ingredients.

† *Vid.* Tractatus Anatomico-Medicus de Ossibus Infantum, p. 188.

‡ CUVIER, Leçons d'Anat. Compar. tom. iii.

§ *Vid.* Fox on the Teeth.

This fact is still further proved by the changes which the teeth undergo during the lifetime of the animal, which is very remarkable in the elephant.

The great sensibility of the teeth proves that they have *Nerves*.

The Nerves enter the roots of the teeth, and may be traced into their bony canals, and, in proportion to the bulk of the teeth, are larger than in almost any other organ of the body *.

The *Nerves* of the teeth in the under jaw, are derived from the inferior maxillary nerve; and where the nerve enters the under jaw, it is much larger than where it passes out at the anterior mental foramen; as, during that course, the nerves of the teeth are sent off from it; and these nerves may be traced through the osseous canals of the teeth.

The *Nerves* of the teeth of the upper jaw are derived chiefly from the second part of the fifth pair of nerves; and those of the under jaw from the third part of the fifth pair.

The teeth of animals, during the progress of life, are much exposed to attrition, and also to various accidents. Animals, therefore, are provided with a succession of teeth.

Man is provided with two sets of teeth. Some individuals have had three sets.

* *Vid.* Monro on the Nervous System.

Of the Teeth in the Adult.

These were formerly divided into three classes, *the Incisores, Canini, and Molares.* The molares have been divided by more modern anatomists, into two classes, *the Bicuspidati* and *Molares.*

The Incisores of the upper jaw pass over those of the under jaw, and, owing to their oblique situation, act like scissars in dividing the food.

The Canine, or *Laniarii* of LINNÆUS, on account of their strength and thickness, are well constructed for perforating and tearing animal substances.

The four fore-teeth in each jaw have been named *Incisores*, as they cut the aliment. They are formed into a sharp cutting edge at their base, by their foreside turning inwards, while they are sloped down and hollowed behind.

The *Incisores* of the upper jaw are broader and longer than those of the under jaw.

When the stamina of two sets are formed, each has its own socket; those nearest the edge of the gums being placed more forwards, and the others are lodged farther back within the jaw bones.

Cuspidati, or Canine Teeth.

The Canine teeth have been named from their likeness to the teeth of the dog. They are broad-

er, longer, and stronger than the Incisores. Their bases are formed into a sharp edge, as the *Incisores* are; only, that the edge rises into a point in the middle. Each of them has generally but one long root, though sometimes they have two.* The roots are crooked towards the end. The *Canini* of the upper jaw are larger, longer, and with more crooked roots than those of the under jaw. The form of their base is fit both for piercing and cutting; and the long crooked root of each makes it secure in the socket.†

There are five *Dentes molares*, or *Grinders*, ‡ in each side of each jaw; in all twenty. Their bases are broader, more scabrous, and with a thinner cortical substance than the other teeth. They have also more roots; and as these roots generally divaricate from each other, the partitions of the sockets between them bear a large share of the great pressure they suffer.

The base of the first grinder has an edge pointed in the middle, on its outside, resembling the *Canini*; from which it slopes inwards, till it rises again into a point. It has generally but one root, which sometimes is long and crooked at its point.

* Fauchard, Chirurgien Dentiste, chap. I.

† The enamel is equal in thickness all around these teeth.

‡ Μυλιται, γόμφοι, μύλοι, πλατεῖς, φραστῆρες, maxillares, mensales, clavales, buccarum.

The second *Dens molaris* has two points on its base, rising almost equally on its out and in side. It has two roots, either separate or run together, but shorter than the root of the first. These two anterior grinders are much smaller than the three that are placed farther back in the mouth.

The third and fourth are very broad in their bases, with four or five points standing out; and they have three or more roots.

The fifth, called, commonly, *Dens sapientiæ*, from its coming through the gums later than the other grinders, has four points on its base, which is not so large as the base of the third and fourth, and its roots are less numerous.

The *Incisores* of the upper jaw are broader than those of the lower jaw; hence the superior grinders are placed farther back than the lower ones, that when they are brought together, by shutting the mouth, the points of the grinders of the one jaw enter into the depressions of the opposite grinders; and they are all equally applied to each other, notwithstanding the inequality of their surfaces.

From the numerous roots of the *Dentes molares*, the lateral pressure in grinding does not render them loose; and as the sockets in the upper jaw are more spongy, and the teeth are more liable, by their situation, to fall out, * the grinders there have more numerous and more separat-

* Galen. de Ossib. cap. v.

ed roots than in the lower jaw. * The number, however, of the roots of the teeth of both jaws is very uncertain. Sometimes there are more, sometimes fewer. Frequently the roots are joined together; at other times they are all distinct. The disposition of such as are distinct is also various; for in some the roots stand out streight, in others they separate, and in others again they are crooked inwards. When the roots are united, we can still distinguish them, by remarking the number of small holes at their points, which determine the number of roots each tooth ought to be reckoned to have. †

Of the Formation of the First Set of Teeth.

The teeth are formed upon *Pulps*, which are contained within the alveolar processes of the jaw.

Upon examining the fœtus in utero, about the fourth or fifth month after conception, we find that the alveolar processes are not completely formed. There is a *large canal in the jaw*, which, at different places, is imprest by the pulps of the teeth.

Even at this very early period, this canal is not of a very uniform breadth. It is adapted to

* Fauchard, Chirurg. Dent. chap. I.

† The above is the description of the teeth by Dr Monro primus.

the teeth, and therefore considerably broader at the back than at the fore part. In the bottom of this groove, the internal maxillary bloodvessels and nerves are disposed, which afterwards are lodged in a distinct canal.

In a short time, there are a *number of ridges, which extend from the bottom and inner sides of this canal*, and which form sockets for the teeth.

These sockets extend very quickly, and contract at their upper parts; so that, at the time of birth, there is found only beneath the gum a small transverse fissure.

In consequence of this structure, the teeth within the jaw are not injured while the child is sucking.

The alveolar processes of the grinding teeth are situated immediately before the tuberosities of the upper jaw, and the coronoid processes of the under jaw.

The puips of the teeth are involved in capsules, which consist of two membranes, in both of which there is a great number of bloodvessels. The external membrane adheres to the gum, and the internal to the pulp.

The pulps of the teeth are at first of a gelatinous consistence, nearly of the figure of the tooth, and adhere to the inner surfaces of the gums. The pulp of each tooth is contained in its proper capsule, which is shaped like the base of the tooth, but without roots; which capsule

is attached, by means of its nerves and bloodvessels, to the bottom of the alveolar processes; and its upper part is attached to the inner side of the gums.

The pulp becomes gradually firmer and larger, so that at length it acquires the shape and size of the tooth about to be formed upon it.

The *Ossification* begins about the sixth month after conception, upon the pulps, in the form of spots; the situation of which corresponds with the points of the teeth.

The number of these Ossifications corresponds with the eminences on the pulp; these gradually increase, and *form a thin shell of bone*, which covers the surface of the tooth. In the Incisor teeth, there are generally three points of ossification; in the Canine only one point; and in the Molares four or five points of ossification; and these increase, in some, until their bases are united.

The Ossification in the bases takes place *in a lamellated manner, and from without inwards*; and the bony shells which form the teeth are a little contracted at the collar of the tooth.

At the period of birth, the outer shells of five teeth are found on each side of each jaw, or of twenty teeth.

The bodies of the teeth are first converted into bone; and the ossification goes on by a successive deposition from without inwards; the layer

next the enamel being first formed, and the other layers being added within it.

The roots are then added to the teeth, and are formed upon the pulp, which is elongated in consequence of the pressure made upon it by the progress of the ossification of the body of the tooth.

When there are two or more roots, the osseous fibres extend across the under part of the bodies of the teeth, and leave vacant spaces, through which the processes of the pulp are protruded, and upon which the roots are formed.

Of the Formation of the Enamel.

The Enamel is secreted by the outer membrane of the capsule of the pulp, and is deposited.

The Enamel, when first formed, is so soft, that it may be scraped by the nail.

The Enamel is at first perfect on the cutting edges, or protuberances, of the tooth ; and it does not extend beyond the neck of the tooth. *The Enamel* continues to be secreted as long as the teeth are contained in their capsules. The membrane which secretes *the Enamel is but of temporary duration : after having performed its office, it disappears.* The teeth, by becoming larger within their sockets, stretch, and at length burst their capsules, which are removed by absorption.

The gum is also removed, and the tooth appears through it : hence all that portion of membrane which loosely surrounded the body of the

tooth, is destroyed, when the tooth has risen to its proper height.

The bony part of the tooth, however, continues to grow after the teeth have cut the gum: about one third of the length of the root is added, by which the tooth is elevated, and cuts the gum.

Of the Period at which the First Set of Teeth, or Temporary Teeth, appears.

There is the utmost variety as to the time at which the teeth appear.

In a stout, healthy child, the Incisor teeth of the under jaw show themselves between the sixth and seventh month after birth; but, in a puny, sickly child, not until the child is perhaps a year old.

There are some diseases which seem to have a specific effect in arresting the growth of the teeth. I have repeatedly observed, that children labouring under the chronic form of the disease called *water in the head*, do not get their teeth till they are two or three years old.

The larger incisors of the under jaw first cut the gum.

A few weeks after the central incisors of the under jaw have cut the gum, those of the upper show themselves, and, in the next place, the lateral incisors of both jaws. When the child is about a year and a half old, the smaller grinders

of the lower jaw cut the gum; these are followed by the smaller grinders of the upper jaw.

In the fœtal jaw, the smaller incisor, and the smaller grinding teeth, are in contact; the canine are lodged deeper in the jaw. About the twentieth month, the canine teeth show themselves: in the first place those of the under jaw, and soon after those of the upper jaw.

.The Caninus appears after the first molares, or about the 16th or 20th month; as it is out of the line, and, till the jaw extends, there is not room for it; and the jaw at this place grows in a greater proportion than at any other part.

The posterior or larger Molares appear between the 25th and 30th month.

It may not be improper to add, that there is great irregularity as to the time the teeth are cut.

Of the Shedding of the First Set of Teeth, and of the appearance of the Second Set.

As there is the utmost variety with regard to the time at which the teeth appear, so there is very great variety respecting the time at which teeth are shed. In a child at birth, the rudiments of the first and second sets are found within the jaw; the bases of the second set are formed long before they first cut the gum.

Whilst the first are receiving roots, and cutting the gum, the second set is dormant, and continues so, long after the first have appeared.

About the sixth year, all the second set, except-

ing the wisdom teeth, are ossified; so that, at this period, there *are no less than forty-eight teeth in the jaws:* the first set, consisting of twenty, have appeared; and the second set, consisting of twenty-eight, lye within the jaws.

The sixth tooth, or first large molares of the adult, is also dormant.

The first set of teeth fall out in consequence *of their roots being absorbed*, which absorption takes place in consequence of the enlargement of the second set; by which, pressure is made on the bony partitions between the sockets of the first and second set of teeth, and also on the roots of the first set of teeth; which leads to the absorption of the bony partitions, as well as of the roots of the first set.

In consequence of the above changes, the second set comes forwards, and replaces the first, but are contained in their original sockets.

The first set generally begin to fall out when the child is about six or seven years old.

The anterior molares of the second set generally appear first; then the larger incisors of the lower jaw; in a month or two, the larger incisors of the upper jaw; then the molares of the child become loose, to make way for the smaller molares of the second set: the canine generally follow some time after; and, last of all, the larger molares.

The shedding of the first set is generally not completed in less than six years; and in some

instances, some of the first set of teeth remain in the jaws during the greater part of life.

Of the Formation of the Second Set of Teeth.

The second set, like the first, is formed upon *pulps, and these pulps are parts or elongations* of the *pulps* of the first set, which are sent out as soon as the rudiments of the first set have made some progress.

The pulps of the second set of teeth *are originally within the same socket, and adhere to the capsules of the first set*; and these capsules are so intimately connected, that it is impossible to separate the one from the other, without lacerating one or both. By degrees little niches are formed in the internal alveolar plate, which gradually form a *distinct socket around these sacs for the second set of teeth.*

Dr BLAKE, who, I believe, discovered the connexion between the sacs of the first and second sets, has very fully explained the above mentioned facts in the following passage.

'As the sacs of the permanent teeth advance, 'the sockets of the temporary ones become en- 'larged, and little niches are formed in the in- 'ternal plate of the alveolar processes, answering 'to each socket, which are situated rather later- 'ally, that is to say, at a greater distance from 'the symphysis, or centre of the jaw, than the 'centre of each respective temporary socket.

'These niches do not penetrate so deep as to

'the bottom of the temporary sockets, but increase in proportion with the size of the permanent sacs, and gradually form a distinct socket round each of them.

'There is, however, an opening left immediately under the gum, through which the membranes of both sets of teeth continue to be connected.'

The second set of teeth come forwards under the first set.

The wisdom teeth begin to be formed about the eighth or ninth year, but do not appear until the twentieth or twenty-first year; or sometimes until a later period of life.

The teeth fill the jaws, by which the principal grinders are near to the condyles of the jaw, both for the sake of strength, and also that every part of the food may be manducated.

Two sets are given, not merely as they last longer, but also to fill the jaw in its enlarged state; for the teeth could not grow like the soft bone.

Before concluding this section, it may not be improper to call the attention of the reader to the very different sizes of the alveolar processes and teeth in different nations, of which plates XIX. and XX. afford very strong examples.

Changes in the Teeth and Jaws in advanced Life.

The teeth, in persons far advanced in life, are worn down by *manducation*; the enamel is worn

off the bases of the teeth ; yet the bony part of the teeth continues to live ; and, after the points are worn down, the enamel at the sides acts like the enamel in the teeth of a graminivorous animal, and keeps the tooth sharp.

The molares of persons advanced in life are generally shed before the incisors, showing what kind of food is fittest for the old.

Of the variety of the Jaw at different periods of Life.

There is perhaps no bone in the human body which, during the progress of life, undergoes a greater alteration in its figure than the under jaw bone.

These changes in the shape of the jaw are in a great measure owing to the teeth. *

Before the appearance of the teeth, the jaws are *proportionally shorter* than in animals fully grown, which has a considerable effect on the FACIAL LINE. †

The jaws in an infant are not only shorter, but also not so deep as in the adult.

* *Vid.* Plate 24th.

† For a full account of the Facial line, *vid.* DR CAMPER on the Connexion between the science of Anatomy, and the arts of Painting and Sculpture, translated by DR COGAN, London, 1794. In the same book, the differences in the form of the skull, at different periods of life, are very fully and accurately explained.

It has been stated, that in a child at birth the depth of the jaw is about the seventh part of that of the head; at the age of thirty, it measures somewhat less than the fifth part. As the teeth advance, the posterior angle of the jaw is pushed back, and becomes more nearly a right angle; and the posterior part of the rising branch, which was at first very oblique, becomes straight.

From what has been said respecting the teeth, it is obvious, that as the incisor teeth and grinding teeth of the child are at first in immediate contact; that the jaw must grow rapidly in order to make room for the eye teeth; and, as the grinding teeth of the second set are more numerous than those of the first, the jaws must extend very much between the coronoid process and the grinders of the first set, to make way for the grinders of the second set: hence we find, that the jaws are in a constant state of growth until the twentieth year, in order to make room for the addition of the wisdom teeth.

When the teeth fall out, the alveolar processes disappear in the upper, as well as in the under jaw. We sometimes observe an osseous net work which fills up some of the alveolar processes; and the distance between the bony palate and the chin becomes much less.

When the jaws are shut as in plate 23d, the under jaw projects considerably beyond the upper. The posterior angle becomes *more obtuse*, because it is not pushed back by the teeth; and

the condyle becomes lower in respect to the coronoid process; and hence the anterior part of the under jaw is carried so far forward, and does meet the upper jaw, excepting at the back of the mouth, where the greatest force can be employed during mastication.

EXPLANATION OF PLATE XXIII.

This plate represents the skull of an old man, to point out the remarkable form of the upper and under jaw bones in very advanced life.

A. The upper jaw.

B. The angle of the under jaw.

C. The anterior part of the under jaw projecting beyond the upper jaw.

D. The styloid process of the temporal bone, which is longer than usual.

Authors on the Structure and Diseases of the Human Teeth.

EUSTACHII, De Dentibus.
ALBINI, Annot. Academ. lib. II. Leidae Batav. 1737.
J. HUNTER'S Natural History of the Human Teeth. London, 1771.
RUSPINI. Treatise on the Teeth, their structure and diseases. London, 1771.
BLAKE, Disputatio Medica Inauguralis de dentium formatione in homine et variis animalibus. Edinburgi, 1798.
FOX'S Natural History of the Human Teeth. London, 1803.

For an account of the means employed by savage nations to alter the form of the Teeth, see

CHURCHILL'S Collection of Voyages, vol. v.
FORREST'S Voyage to New Guinea.
MARSDEN'S History of Sumatra.
HAWKESWORTH'S Voyages, vol. iii. p. 349.

SECT. II.

OF THE OS HYOIDES.

The *Os Hyoides*, * which is situated horizontally between the root of the tongue, and the *Larynx*. It is properly enough named *Hyoides*, from the resemblance it bears to the *Greek* letter υ; and may, for a clearer demonstration of its structure, be distinguished into its *Body*, *Cornua*, and *Appendices*.

The body is the middle broad part, convex before, and hollow behind. The convex fore part is divided into two, by a ridge, into the middle of which the *Mylo-hyoidei*, and into the sides the *Stylo-hyoidei* muscles are inserted. Above the ridge, the bone is horizontal, but pitted in the middle by the insertion of the two *Genio-hyoidei* muscles, and a little hollowed more laterally by the *Basio-glossi*. Below the ridge it is convex, but a little flatted in the middle by the *Sterno-hyoidei*, and pitted more externally by the *Coraco-hyoidei*. The concavity behind faces backwards and downwards to receive the *Thyroid* cartilage, when the *Larynx* and the *Os hyoides* are pulled towards each other by the action of the *Sterno-hyoidei* and *Hyothyroidei* muscles; and to its upper edge, the liga-

* Hypsyloides, Lambdoides, παραστάτη, φαρυγγέτερον, os gutturis, os linguæ, os morsus Adami, assessor, os laude, bicorne.

mentous membranes of the *Epiglottis*, tongue, and *Thyroid* cartilage, are fixed.

The *Cornua* of the * *Os hyoides* are stretched backwards from each side of its body, where often a small furrow points out the former separation; for in young ſubjects, the body and *Cornua* are not one continued substance, as they come afterwards to be in adults. These *Cornua* are not always streight, nor of equal length; their two plain surfaces stand obliquely sloping from above outwards and downwards. Into the external, the *Cerato-glossus* is inserted above, and the *Thyro-hyoideus* muscle below; and to the one behind, the ligamentous membrane of the tongue and *Larynx* adheres. Each of the *Cornua* becomes gradually smaller, as it is extended from the base; but ends in a round tubercle, from which a moveable cartilage stands out, which is connected to the upper process of the *Cartilago Thyroidea*.

Where the body of the *Os hyoides* joins on each side with its *Cornua*, a small styliform process, called *Appendix*, † rises upwards and backwards, into which the *Musculi Stylo-hyoidei alteri*, and part of the *Hyo-glossi* muscles are fixed. From each of them a ligament is sometimes extended to the *Styloid* processes of the temporal bones, to keep the *Os hyoides* from being drawn too much forwards or downwards. The part of this liga-

* Crura, Latera inferiora.

† Crura superiora, Latera superiora, Ossa graniformia.

ment next to these processes sometimes forms into several cartilages, which afterwards ossify in old people. *Ruysch* * ſays that he has seen this ossification continued as far up as the styloid processes, which were therefore joined to the *Os hyoides* by *Anchylosis*.

The substance of the *Os hyoides* is cellular, but covered with a firm external plate, which is of sufficient strength to bear the actions of so many muscles as are inserted into it.

It is not articulated with any bone of the body, except by means of the muscles and ligaments mentioned.

The use of the *Os hyoides* is to serve as a solid lever for the muscles to act with, in raising or depressing the tongue and *Larynx*, or in enlarging and diminishing the capacity of the *Fauces*.

At birth, this bone is in a cartilaginous state; excepting a small point of bone in the middle of its body, and in each of the *Cornua*. The *Appendices* frequently remain cartilaginous many years. †

* Advers. Anat. Dec. 3. § 9.

† The above description of the *Os hyoides* is taken from the Osteology of Dr Monro primus.

SECT. III.

OF THE SOFT PARTS OF THE MOUTH AND ITS APPENDAGES.

In a former part of this book, the structure of the upper and under jaws, which form the bony part of the cavity of the mouth, has been explained; and therefore, we now proceed to the description of the softer parts, namely, to that of the *Lips* and *Cheeks*, which form the fore part of the mouth and its sides, and the other parts contained within the mouth.

Connected with the mouth, there are muscles for performing the compound motion of the lower jaw; there are glands which secrete mucus and the saliva; and at the back part of the mouth there is a moveable muscular membranaceous arch, which assists in guiding the bolus of food into its passage towards the stomach, and opposes its return through the nostrils.

Within the mouth, there is the tongue, an instrument of speech, the organ of taste, and which also assists in deglutition. A musculo-membranous sac communicates with the posterior part of the mouth, which serves the double office of giving passage to the air into the lungs, and of giving passage to the prepared aliment, before it reaches the gullet; and at the top of the wind-pipe, there are muscles which moderate the air

in its passage to the lungs, producing different sounds.

Such being the varied purposes of the parts of the mouth, we should at first sight suppose, that the functions of these could not be performed without interfering with each other; and yet, there is only one instance of interference, viz. *in sucking and breathing;* and hence the necessity of a passage for air through the nostrils, into the lungs, whilst the lips are closely applied to the nipple.

The lips and cheeks, which extend from the cheek bones, upper jaw, and front of the nose, to cover the teeth, are composed of skin, cellular substance, fat, muscles, glands, and hairs.

In the lips, there is a much smaller proportion of fat than in the cheeks; hence these are nearly of the same thickness at all times of life. The fat collected in the cheeks may tend, not only to facilitate the movements of the muscles, but also to defend the mucous and salivary glands.

The lips and cheeks are lined by a soft, vascular, mucous membrane, which forms the frænа of the lips; and then, becoming somewhat firmer, forms the gums, by means of which the teeth are secured in their sockets.

The cheeks and lips are largely supplied with blood; and, after their bloodvessels have been successfully filled, a number of pointed bodies may be observed on the lips, which project from their surface, and have been called Villi. The

gums are spongy, and of a red colour, from the quantity of blood they receive.

Sect. IV.

OF THE PALATE.

The roof of the mouth has been called Palate.

The palate is made up of hard and soft parts. In the erect posture it is placed horizontally.

The bony part of the palate consists of the palatine processes of the superior maxillary bones, and of the palate bones; and these form, in the adult, a bony arch, which is covered by a membrane marked by transverse lines, and divided longitudinally; which membrane, at different periods of life, varies much as to its thickness, being in the infant thick before the teeth appear, and opposing their protrusion; and in advanced old age, when the teeth have dropped out, it becomes still thicker.

The mouth is bounded behind by a musculo-membranous partition, called the *Soft Palate*, or *Velum Palati;* which is fixed to the proper palate bones, and is suspended from the middle of these over the basis of the tongue. The inferior part of it is loose; and from the centre of it, the conical shaped body called *Uvula*, which

is of various lengths, and peculiar to Man and to Simiæ, takes its rise.

The lateral edges of the palate are subdivided into two musculo-membranous folds, the anterior of which is fixed to the base of the tongue; and the other is fixed to the side of the pharynx; and between these folds the *Tonsils* are placed. Muscles imbedded within the arches of the palate, compress the tonsils during deglutition, and press out their contents.

SECT. V.

OF THE TONSILS.

THE Tonsils are grey-coloured and soft glands, somewhat of an oval shape, and various in size, commonly about the size of an almond, with several openings on the surface, leading into cells within the substance of the glands, which are lined by the membrane of the mouth.

The tonsils secrete, in the healthy state, a transparent mucus; which, when in a morbid state, assumes a white colour; in inflammatory cases giving the appearance of a slough.

There are also a number of small mucous glands distributed over the back of the tongue, velum pendulum palati, uvula, and in the vicinity of the tonsils.

SECT. VI.

OF THE TONGUE.

THE Tongue is not only an organ of taste and speech, but also constitutes a part of the organs of deglutition.

It is firmly supported by the bone called Os Hyoides.

The tongue has been divided, by anatomists, into three parts, viz. a base, body, and point; and into two surfaces, an upper and under. The tongue is connected by a doubling of the skin called *Frænum Linguæ;* and its sides are fixed to the styloid processes, and to the lower jaw by ligaments.

There is a line which runs in a longitudinal direction along the tongue; and towards the root of this organ there is an oval-shaped depression, called, after MORGAGNI, *Foramen Cæcum Morgagni.*

The tongue is covered by a cuticle, which forms sheaths for its papillæ, by corpus mucosum and cutis vera.

The Papillæ of the tongue, on account of their size, have been arranged *into three classes.*

The Papillæ Maximæ, or *Lenticulares*, which are perforated in the middle, occupy the base of the tongue, and are small salivary glands.

The Papillæ Mediæ, or *Semilenticulares*, which

are supported on a small stalk, are scattered over the middle of the upper surface of the tongue.

The *Papillæ Minimæ*, or *Conicæ*, are found chiefly at and near to the point of the tongue.

The tongue is made up chiefly of muscles. The middle of it by the muscle called Lingualis; the upper and lateral parts by the muscles called Stylo-glossi; and the lower part by the Genio-glossi.

The tongue is very largely supplied with blood by the branches of the Arteria Ranina; and it receives nerves from three different sources.

The branches of the fifth pair are distributed upon the point of the tongue; those of the ninth pair of nerves upon the sides of the tongue; and those of the eighth supply the basis.

Sect. VII.

OF THE SALIVARY GLANDS.

These are very numerous, and have been divided into two classes, viz. into the large and small. The larger salivary glands are, the Parotid, the Submaxillary, and Sublingual Glands; and are so placed as to be compressed during manducation.

The Parotid Gland occupies the space between the meatus auditorius externus mastoid process, and the angle of the lower jaw; and, stretch-

ing across the face, in part covers the masseter muscle, becoming there much thinner in its substance; and it sends down a process which is in contact with the inferior maxillary gland. The form of this gland is oval; and somewhat flattened before and behind, and lengthened out from above downwards. The parotid gland is covered by the skin, and by some fibres of the platysma myoides, and by a white membrane which envelops the substance of the gland; and the external carotid artery passes through the substance of the gland, dividing, within it, into three branches.

Behind, we find the mastoid process; the sterno-cleido-mastoid muscle, which covers the posterior part of the gland; a little deeper the digastric muscle; and, under it, the external carotid artery.

From the upper part of the gland, the large duct arises.

This gland, in the adult, is of a white colour, inclining to red. In the fœtus it is much redder, and divided into a number of small parts, which have a soft and delicate texture.

There is an accessory gland, situated close to the external border of the masseter, and along the upper border of the duct of the parotid.

This accessory gland does not always exist. Sometimes it sends out its peculiar ducts, which unite with that of the Parotid.

It is in colour and consistence like the Parotid.

This is a gland of the conglomerate kind, consisting of a number of distinct lobes, detached from each other, and united by a cellular substance; and each lobe is composed of a great number of small parts, or grains.

It very rarely happens that much fat is connected with this gland.

Around the gland there are several lymphatic glands.

Of the Ducts of the Parotid Gland.

Each lobule of the gland sends out a small duct. These smaller ducts uniting, form the large duct, which arises from the anterior border of the upper part of this gland.

The duct takes a horizontal direction over the masseter muscle.

Having crossed over the anterior part of the masseter, it then is enveloped in the fat of the cheeks, and pierces the Buccinator muscle, and the internal membrane of the mouth, opposite to the space between the second and third grinder of the upper jaw.

Morgagni has described the duct, as passing "obliquè antrorsum descendens."

Steno describes it as passing horizontally through the Buccinator muscle obliquely, between the fibres of the Buccinator.

The diameter of the duct is but small in pro-

portion to its bulk, as the duct has very thick coats.

The canal of the duct is nearly cylindrical, and has two coats. The external is formed of a dense cellular substance, on the inner side of which there is a mucous membrane. There are many branches of the temporal artery distributed upon the parotid gland; and it receives nerves from the portio dura of the seventh pair.

Of the Submaxillary Gland.

This gland is smaller than the Parotid, somewhat of an oval figure, and situated between the inner surface of the side of the jaw, the Mylo-hyoid and Digastric muscle.

This gland is sometimes continued near to the angle of the jaw; and is sometimes connected with the lower end of the Parotid.

This gland also joins the Sublingual behind the posterior part of the Mylo-hyoid muscle.

The duct of this gland, which arises from its upper and fore part, is large, and has thin coats.

The duct passes between the Mylo-hyoideus and Genio-glossus muscles, along the under and inner edge of the Sublingual gland, and perforates the membrane of the mouth, at the side of the Frænum Linguæ; and is accompanied by the lingual branch of the inferior Maxillary Nerve.

Of the Sublingual Gland.

The Sublingual gland is situated under the anterior part of the tongue, above the duct of the inferior Maxillary gland, between the Mylo-hyoideus and Genio-glossus muscles. The upper part of the gland projects into the mouth.

The ducts of this gland open into the duct of the Submaxillary gland, or a little to the outside of the Frænum Linguæ. A duct similar to the duct of the Submaxillary gland, sometimes opens in the side of the duct of the Submaxillary gland.

The smaller Salivary glands are placed in the lips, cheeks, tongue, and palate; and are of various sizes, in different individuals.

Chemical Analysis of the Saliva.

Saliva appears to be a solution, in a large quantity of water, of albumen, mucus, and certain saline substances, compounds of phosphoric and muriatic acids; with soda, ammonia, and lime. The proportions are conjectured by Dr Bostock to be about eighty of water, and eight of coagulated albumen; eleven of mucus, and one of saline compounds. *

* Vide Murray's Chemistry, third edition, vol. 4th, p. 537.

Sect. VIII.

OF THE PHARYNX.

The Pharynx is a musculo-membraneous bag, of a conical figure, and ſituated behind the tongue and posterior nostrils, upon the bodies of the cervical vertebræ, to which it is loosely connected by a cellular substance.

It is connected to the occipital and sphenoid bones above; to the gullet below; and the larynx is placed before it; and, laterally, it is bounded by the pterygoid processes of the sphenoid bone, the cornua of the os hyoides, and by the carotid arteries and jugular veins.

The Pharynx, through which the air passes into the lungs, and the food into the gullet, communicates with the following parts, which may be readily seen by opening it from behind.

By such a view are seen the oval shaped cavities which lead into the nose; the trumpet shaped opening of the Eustachian tube, which is encircled by cartilage, and therefore always kept open, placed at the communication between the nose and pharynx; the soft palate, with the isthmus faucium under it.

The Epiglottis, covering the projecting larynx, is connected with the root of the tongue at the fore part of the pharynx.

Sect. IX.

OF THE GULLET.

The Gullet, or Oesophagus, is a musculo-membranaceous canal, connected loosely to the neighbouring parts, which extends between the pharynx and stomach, and between the fifth cervical and ninth dorsal vertebra.

It is placed behind the wind-pipe, and between it and the vertebræ of the neck, inclining rather to the left side; and, from the fifth to the ninth vertebra, it inclines rather to the right side, to make way for the aorta.

Within the thorax, the gullet is lodged within the posterior mediastinum, from which its sides receive a covering.

The gullet then inclines somewhat forwards from the spine, and passes through the cardiac opening of the diaphragm.

In its collapsed state, it is nearly flat, both before and behind; but when extended, it assumes nearly the form of a cylinder, excepting where it passes through the diaphragm, where it is somewhat contracted.

The Oesophagus has five coats.

The external coat is cellular, and unites it to the spine behind, and to the trachea before.

The second coat is composed of distinct fasciculi of muscular fibres, * which follow a longi-

* Vide Plate XXIV.

tudinal direction; and, within these there are much thinner muscular fibres, which describe portions of a circle around the gullet.

These muscular coats are connected by loose bands of cellular substance to the innermost coat; so that the gullet, when divided, seems to be a double tube.

The innermost coat is a mucous membrane, and folded where the gullet is contracted; † it is very dilatable; and when the gullet is expanded, the folds difappear.

Upon the surface of the innermost coat there are the orifices of a number of mucous glands, especially at the junction of the gullet with the stomach; and also a net-work of small blood-vessels.

† Vide Plate XXV.

Vide BLEULAND de sana et morbosa Oesophagi structura.

EXPLANATION OF PLATE XXIV.

This Plate represents the back part of the Pharynx and Gullet.

A. A. Point out the oblique muscular fibres of the Constrictores Pharyngis.

B. A small portion of muscular fibres which descend perpendicularly from the posterior part of the Pharynx to the upper and back part of the Gullet.

This stratum of muscular fibres has not, as far as I know, been described or represented by any anatomical author.

a. a. Point out the inner membrane of the Pharynx; the muscular fibres having been removed.

C. C. Point out the longitudinal muscular fasciculi of the Gullet.

D. D. The circular or second stratum of muscular fibres of the Gullet.

EXPLANATION OF PLATE XXV.

This Plate, which was published in my *Thesis de Dysphagia*, represents the termination of the Gullet in the ſtomach. The folds of the internal membrane of the Gullet are seen, as also a white border around the end of the Gullet, which seemed to be formed by the cuticle stopping at this place; for I could not trace it along the villous coat of the stomach.

It may not be improper to add, that Mr E. Home has lately represented the cuticle of the Gullet nearly in the same manner. *

* *Vid.* London Phil. Trans. for 1807, Part II. The representations of the human stomach, and those of animals, are by far the best which have hitherto been published.

CHAPTER III.

OF THE MUSCLES WHICH ARE SUBSERVIENT TO MASTICATION AND DEGLUTITION.

SECT. I.

GENERAL DESCRIPTION OF THE DISPOSITION OF THE MUSCLES OF THE FORE PART OF THE HEAD.

THERE is considerable difficulty in exposing these muscles, as they are thin, mixed with fat and cellular substances, incorporated with each other, and attached to the skin.

On the forehead is seen the frontal part of the *Occipito-Frontalis Muscle;* and a small part of that muscle which descends to the root of the nose.

At the side of the head, there is a thin muscle which raises the ear, and covers the temporal muscles; and before the ear, a small muscle, which pulls the ear forwards; and around the eyeballs, the muscle called *Orbicularis Palpebrarum* occurs.

On the cartilages affixed to the bones of the nose, and which form the Alæ Nasi, a few thin,

scattering fibres are placed, which form a muscle, called, from its office, *Compressor Narium.*

Arising from the side of the nose, and superior maxillary bone, there is a thin muscle passing down to be fixed into the upper lip; and which has been named from its office *the Levator Labii Superioris Alæque Nasi.*

There are three ſmall muſcles which pass obliquely downwards and inwards, to be fixed to the corners of the mouth. Two of these have been named, from their origins from the Zygoma; *Zygomatici;* and the third has been named, from its office, *Levator Anguli Oris.*

There is a triangular shaped muscle which arises from the side of the chin, and which is fixed into the corner of the mouth, which has been named from its office the *Depressor Anguli Oris.*

There is a muscle, of the figure of an oblong square (which is in part covered by the under part of the preceding muscle), which ascends from the chin, and is fixed into the under lip, and has been named from its office *Depressor Labii Inferioris.*

The two last muscles are in part covered by a few thin muscular fibres of a thin muscle of the neck, called the *Platysma Myoides.*

There are a few fibres passing transversely from one platysma myoides to the other, which have been described by SANTORINI under the name *Transversus Menti.*

The muscular fibres which pass around the

mouth, and which have been said to form the Orbicularis or Sphyncter Oris, are also obvious.

Second Layer.

Under the portion of the *Occipito-Frontalis Muscle*, which is fixed into the superciliary ridge, a small rounded muscle is placed, which is fixed into the middle of the superciliary ridge, which has been called *Corrugator Supercilii.*

The Temporal muscle is seen in the temples, and its tendon passing under the Zygoma. A strong muscle, extending downward from the Zygoma to the angle of the under jaw, called from its very powerful effect in manducation, *Masseter*, is distinctly seen.

The muscle called *Buccinator*, extending between the *Masseter* and *Orbicularis Oris*, is seen; the fat, and that part of the parotid gland which covered it, being removed.

Under the Levator Labii superioris, there are a few scattering fibres, which SOEMMERING has noticed (*vid.* his third vol. p. 102.) as a muscle, under the name of *Musculus Anomalus Maxillæ superioris.*

The *Levator Anguli Oris* is now seen arising from the superior maxillary bone, and fixed into the corner of the mouth.

Third Layer.

In this third layer, ALBINUS has represented the insertion of the muscle which draws the eye-

ball towards the nose, and which therefore has been called *Adductor Oculi*; and the insertion of the muscle which raises the eyeball, and which has therefore been called *Levator Oculi*, and the *Obliquus Inferior Oculi*, is also imperfectly seen.

On the side of the Coronoid process of the under jaw, next the mouth, a part of the *Pterygoideus superior* muscle comes into view.

I shall describe, in Classes, more particularly, all the above muscles.

SECTION II.

MUSCLES WHICH MOVE THE LOWER JAW.

The under jaw is elevated and moved laterally by the Temporo-Maxillaris inferior, the Jugo-Maxillaris, and the Pterygoid muscles.

The power of these muscles is very great, even in the human body, of which many striking examples are to be found in the Works of VESALIUS and HALLER. In carnivorous animals, these muscles are of a much greater thickness and strength.

TEMPORO-MAXILLARIS INFERIOR, or *Temporal Muscle.*

This muscle takes its origin from its Aponeurosis, and from the Temporal Fossa, formed by the Os Frontis, Temporis, Sphenoides, Malæ, by ra-

diated fleshy fibres, which, as they descend, become thicker, and which pass under the Zygoma, filling up the space between it and the Temporal bone; and also from the inner surface of the Zygoma.

This muscle is fixed into the coronoid process of the under jaw, by the medium of a tendon, which envelops the coronoid process.

The muscle is covered by a thick tendinous aponeurosis, which is connected with the Temporal ridge, the superior edge of the Zygoma, and outer edge of the Orbit.

The above muscle elevates the under jaw; but it may act with its anterior or posterior fibres in drawing the under jaw backwards or forwards.

Zygomato-Maxillaris, or *Masseter*,

Is a thick strong muscle, which covers and deeply imprints the side of the under jaw-bone.

It takes its origin from the superior Maxilla, and from the inner edge of the Zygoma; and is fixed into the side and angle of the under jaw.

The fibres of the different parts of this muscle cross each other; the outer part slants backwards, and the inner part forwards, so that the fibres in a degree decussate one another.

This muscle concurs with the former in elevating the under jaw.

The outer part of it also aſſiſts in pulling the jaw forwards.

The lateral movements of the under jaw are performed by the Pterygoidei muscles.

PTERYGO-MAXILLARIS MINOR, SUPERIOR, or *Pterygoideus Externus*,

Takes its rise from the outer side of the Pterygoid Plate of the Sphenoid bone, from the tuberosity of the superior Maxillary bone, and from the root of the Temporal process of the Sphenoid bone; and it passes horizontally, and is fixed into the neck and capsular ligament of the under jaw.

This muscle pulls the jaw laterally; and if it be thrown into action with its fellow, the jaw is pulled forwards, by which the fore teeth of the under jaw project before those of the upper jaw.

PTERYGO-MAXILLARIS MAJOR, INFERIOR, or *Pterygoideus Internus*.

This muscle takes its rise from the Fossa Pterygoidea of the Sphenoid bone, and from the Palate bone, and is fixed into the inner side of the angle of the under jaw, being placed nearly opposite to the Masseter muscle, to which, in figure, it bears some resemblance.

This is a powerful muscle in masticating the food; it gives the lateral motion of the jaw; and, when thrown into action, in conjunction with its fellow, the jaw-bone is elevated.

MASTOIDO-MENTALIS, or *Digastricus*.

This is a double muscle: one part of it arises from the groove at the root of the Mastoid pro-

cess of the Temporal bone, and, descending obliquely downwards and inwards through the fibres of the Stylo-hyoid muscle, it is connected to the Os Hyoides by a thin ligament. It then passes obliquely upwards and outwards at an obtuse angle, and is fixed into the middle of the lower jaw at its lower part.

By this muscle, the mouth is opened; and when the jaws are shut, the Os Hyoides is drawn towards the under jaw; and the posterior part of the muscle draws the Os Hyoides towards the Mastoid process of the Temporal bone.

Dr SOEMMERING has stated, that if the lower jaw be fixed, this muscle tends to depress the back of the head upon the spine, and thereby to open the mouth, by elevating the upper jaw: this he states he has observed while a child is sucking. There are some of the muscles which are fixed to the Os Hyoides, and under jaw, and also to the thorax, as the Platysma Myoides: But as these muscles are subservient to other purposes, they shall be mentioned in another place.

SECTION III.

MUSCLES OF THE CHEEKS AND LIPS.

There are ten muscles, which are proper to the lips and cheeks.

The Labialis, or *Orbicularis Oris.*

The fibres of this muscle, which are small, decussate each other at the corners of the mouth; so that this muscle seems to consist of two semicircular muscles.

The outer part of the muscle is formed of the fibres of all the Levatores Labii Superioris and Zygomatici.

The internal fibres form the true Sphyncter Oris.

This muscle shuts the mouth: it brings the lips into contact with each other, or with any substance put into the mouth, as in the act of suction.

A part of this muscle forms the Nasalis Labii Superioris of Albinus.

Zygomato-labiales Major and Minor, or the *Zygomaticus Major and Minor,*

Arise from the convexity of the Os Malæ, and descend obliquely forwards, and terminate in the corner of the mouth, where their fibres are incorporated with those of the Depressor Anguli Oris.

When the muscles of opposite sides act at the same time, they draw the corners of the mouth outwards, as in laughing.

The SUPER-MAXILLO-LABIALIS MINOR, or the *Levator Anguli Oris,*

Arises from the upper jaw bone, immediately below the Foramen Infra-orbitarium; the fibres of the muscle pass obliquely downwards, and outwards to the corner of the mouth.

This muscle raises the corner of the mouth.

SUPER-MAXILLO-LABIALIS MAJOR ET MEDIUS, or the *Levator Labii Superioris Alæque Nasi.*

This muscle arises from the Nasal process of the upper jaw, and from that part of the bone below the orbit.

The muscle is fixed into the Ala Nasi, where it is united with the Compressor Narium, and into the upper lip.

This muscle raises the upper lip, and the Ala Nasi, and thereby dilates the nostril.

The MAXILLO-LABIALIS INFERIOR, or the *Depressor Anguli Oris.*

This muscle, which is of a triangular form, arises from the side of the under jaw; it crosses the lower part of the Depressor Labii Inferioris, and becomes narrower as it ascends, and unites in the corner of the mouth with the Zygomatic and Levator Anguli Oris.

It depresses the corner of the mouth, as in crying.

The MENTO-LABIALIS, or *Depressor Labii Inferioris.*

This muscle arises from the anterior, but chiefly from the lateral part of the under jaw.

The fibres of this muscle pass obliquely upwards and inwards, till it joins its fellow in the middle of the lip; and is fixed by a broad plate of muscular fibres into the under lip.

This muscle opens the mouth, by depreffing the under lip.

Levator Menti, or *Levator Labii Inferioris,*

Arises from the alveolar processes of the incisor and canine teeth of the lower jaw, and terminates in the under lip and skin of the chin.

The use of this muscle is, to raise the under lip when it has been depressed; and it also corrugates the chin, and turns outwards the lip.

Depressor Labii Superioris et Alæ Nasi.

This small muscle arises from the alveolar processes of the incisor and canine teeth of the upper jaw; and it is fixed into the upper lip and root of the wing of the nose.

This muscle draws the upper lip downwards.

BUCCO-LABIALIS, or *Buccinator.*

This muscle covers the membrane of the cheek.

It arises from the pterygoid process of the sphenoid bone, and from the space between the last grinder and coronoid process of the lower jaw. The fibres of the muscle are transverse in respect to the face; and they terminate in the orbicularis muscle in the corner of the mouth.

This muscle draws the angle of the mouth backwards, and corrugates the cheek; hence is employed in expelling the contents of the mouth, or in blowing wind instruments; and it is also employed in preſſing the cheek inwards, and in putting alimentary substances between the teeth.

Sect. IV.

MUSCLES OF THE PALATE.

The Petro-Palatinus, or *Levator Palati.*

This muscle arises from the point of the petrous part of the Temporal bone, from the cartilage of the Eustachian tube, from which it descends, and is fixed into the middle of the soft palate, and root of the uvula.

It draws the soft palate upwards during deglutition, so as to prevent the food from getting into the nose.

Pterygo-Palatinus, or *Circumflexus Palati.*

This muscle lyes along the pterygoid proceſs, and spinous processes of the Sphenoid bone.

It arises from the osseous part of the Eustachian tube, and the internal pterygoid process; and it then sends out a tendon, which revolves around the hook-like process of the internal pterygoid process; and is then fixed into the middle of the velum palati, and os palati, by means of a broad membrane.

This muscle expands the velum laterally, and also tends to depress it.

Palato-Uvularis, or *Azygos Uvulæ.*

This muscle is enclosed within the membrane of the Uvula.

It arises from the back part of the palate bones, and terminates in the Uvula, which it draws upwards.

Glosso-Palatinus, or *Constrictor Isthmi Faucium.*

This muscle is contained within the anterior arch of the soft palate. It consists of a few thin muscular fibres, which arise from the side of the root of the tongue, and is fixed into the middle of the velum palati. This muscle shuts the opening into the fauces.

Pharyngo-Palatinus, or *Palato-Pharyngeus.*

This muscle is composed of a thin stratum of muscular fibres, which are covered by the membrane of the posterior fold of the soft palate.

This muscle arises from the insertion of the circumflexus palati, and the root of the Uvula.

This muscle is fixed into the middle constrictors of the pharynx, and into the upper and back part of the thyroid cartilage.

By these muscular fibres, the Velum and Uvula are drawn downwards, by which the passage into the nostrils is shut during deglutition; and they also assist in propelling the food into the fauces.

SECT. V.

DISPOSITION OF THE MUSCLES OF THE FORE PART OF THE NECK.

First Layer.

Upon removing the skin and cellular substance of the fore part of the neck, a thin tendinous membrane presents itself, under which there is a thin and broad muscle, which covers the greater part of the fore part of the neck; a part of the side of the face; and a portion of the upper part of the chest; and which has been named *Platysma Myoides*.

Second Layer.

Under the Platysma Myoides, a strong muscle, extending obliquely upwards from the breast bone, and collar bone, to be fixed into the mastoid process of the temporal bone, is seen, called *Sterno-Cleido-Mastoid Muscle*.

Covering a part of the trachea, may be seen the thin muscle arising from the breast-bone, and fixed into the os hyoides, called *Sterno-Hyoideus;* and, higher up the neck, a part of a muscle which has passed under the sterno-cleido-mastoid muscle, which, from its origin from the scapula, and insertion into the os hyoides, has been called *Omo-hyoideus.*

Third Layer.

By removing the above mentioned muscles, the Thyroid and Cricoid cartilages of the larynx are seen; and, covering the fore part of the trachea, a muscle, which arises from the breast-bone, and is fixed into the thyroid cartilage of the larynx, and which has therefore been called *Sterno-Thyroideus;* and also a muscle which arises from the thyroid cartilage, and is fixed into the os hyoides, and which has hence been named *Thyro-Hyoideus.*

SECT. VI.

DISPOSITION OF THE MUSCLES OF THE OS HYOIDES AND TONGUE.

To get a distinct view of the muscles of the os hyoides and tongue, the head should be thrown back, in order to put these muscles upon the stretch.

First Layer.

Upon the skin, cellular membrane, and tendinous aponeurosis being removed, the following muscles come into view.

The anterior head of the *Digastric Muscle*, extending between the symphysis of the lower jaw and os hyoides, and the posterior head of the same muscle passing through the *Stylo-Hyoid Muscle*, downwards and forwards, to be fixed to the os hyoides; and between the two heads of the muscle, the submaxillary gland is placed.

Second Layer.

Upon detaching the above named muscles, the thin and broad muscle, called *Mylo-hyoideus*, comes into view, extending between the os hyoides, and a considerable portion of the under jaw.

The stylo-glossus muscle also comes into view, arising from the styloid process of the under jaw, and supported by its ligament, and paffing downwards to be fixed into the tongue; and a little below that muscle, another muscle, taking its rise also from the styloid process, and passing downwards to the pharynx, called hence *Stylo-pharyngeus*, comes into view.

Between the two preceding muscles and the *Mylo-hyoideus* muscle, there is the *Hyo-glossus* muscle, with its fibres passing nearly perpendicularly downwards to be fixed into the tongue.

A part of the constrictores pharyngis is alſo seen.

Third Layer.

Upon the preceding muscles being removed, the *Genio-hyoideus*, passing betwixt the symphysis of the under jaw and os hyoides, appears; and on the side of it, next the pharynx, (suppos-ing the head to be viewed in the profile), the *Genio-hyo-glossus.*

SECT. VII.

MUSCLES FOR MOVING THE OS HYOIDES.

MAXILLO-HYOIDEUS, or *Mylo-hyoideus.*

This thin, flat, and broad muscle arises from a ridge on the inner side of the jaw, which extends between the chin and last grinding teeth. The fibres pass forwards and downwards, to the symphysis of the jaw, and are fixed into the body of the os hyoides. There is a portion of tendon in the middle of the muscles, of opposite sides, extending from the symphysis of the lower jaw, to the base of the os hyoides.

This muscle elevates the os hyoides; and, when the os hyoides is fixed, it may depress the under jaw.

Genio-hyoideus.

This rounded muscle, which is placed under the former, passes from the symphysis of the under jaw obliquely downwards and backwards to the middle of the basis of the os hyoides. By this muscle, the os hyoides is elevated, and drawn forwards towards the chin, when the jaws are shut.

Omo-hyoideus.

This thin and flat muscle arises from the superior Costa of the Scapula. It ascends obliquely forwards and inwards; and, when under the sterno-mastoid muscle, it is tendinous; it again becomes fleshy, and is at length fixed into the lower margin of the base of the os hyoides.

This muscle draws the os hyoides obliquely downwards and backwards.

Sterno-hyoideus.

This is a thin flat muscle, which arises from the outer part of the uppermost bone of the Sternum, from the first rib and from the clavicle.

It covers the surface of the Trachea; and it is at length inserted into the middle of the lower edge of the basis of the Os Hyoides, between the insertions of the Omo-hyoidei muscles.

Sterno-Thyroideus.

This muscle is placed behind the preceding

muscle, and its origins are the same as in the preceding one. It covers the Jugular vein, the Carotid artery, the Trachea, the Thyroid gland and its vessels.

The muscle terminates in the wing of the Thyroid Cartilage.

Hyo-thyroideus.

This muscle is the continuation of the preceding; it arises from the wing of the Thyroid Cartilage, and ascending, is fixed to the base and Cornu of the Os Hyoides.

This, like the preceding muscle, draws towards each other the Os Hyoides and Larynx.

Stylo-hyoideus.

This muscle takes its rise from the Styloid process of the Temporal bone; it descends obliquely downwards and forwards, and is fixed to the Cornu of the Os Hyoides at its junction with the body of the bone. The Digastric generally passes through this muscle. This muscle draws the Os Hyoides upwards and to one side.

Sect. VIII.

MUSCLES OF THE TONGUE.

The Tongue is chiefly composed of muscular fibres, for performing its varied movements; and

there is no part of the body which exhibits a more remarkable instance of the variety, force, extent, velocity, and precision of muscular action.

The *Lingualis* * is usually described as a mass of muscular fibres in the substance of the tongue, extending from the base to the point of the tongue, between the Hyo-glossus and Genio-glossus muscles.

It may be proper to add, that this muscle is by no means well defined, for its fibres are much involved in the adjacent muscles.

This muscle, which is fixed into the tip of the tongue, raises the tip of the tongue, and brings it backwards.

Hyoglossus Muscle.

This muscle arises from the base, and one of the Cornua of the Os Hyoides, and terminates in the side of the tongue, near the Stylo-glossus.

This muscle depresses the edge of the tongue.

Genio-hyoglossus Muscle.

This muscle arises from the symphysis of the under jaw; and its fibres pass in a radiated manner to be fixed to the point, middle, and apex of the tongue, and are intimately mixed with those of the Lingualis and Hyoglossus muscles. The muscle is also attached to the body of the Os

* There is certainly an impropriety in this term, as the names of the other muscles which move the tongue are of Greek origin.

Hyoides. This muscle raises or depresses the tongue, moves it from one side to another, and draws the tongue forwards, so as to push it out of the mouth; or pushes it backwards, or pulls it downwards.

This muscle also pulls the Os Hyoides towards the Chin.

STYLO-GLOSSUS.

This muscle takes its rise from the Styloid process of the Temporal bone, and is fixed into the side of the tongue, near to its point.

This muscle draws the tongue to one side, and backwards.

Besides the above muscles, there are a number of short fibres distributed through the substance of the tongue, which have been named and represented by MALPIGHI and DU VERNEY under the names of Fibræ Longitudinales, Transversæ, Perpendiculares.

These fibres may serve as auxiliaries to the preceding muscles, or they may act separately; and their action is limited to the particular part of the tongue where they are situated.

SECT. IX.

MUSCLES OF THE PHARYNX.

The Pharynx is covered behind by a thin, though very distinct, stratum of muscular fibres, which follow an oblique course. *Vide* Plate XXIV.

The fibres of the right and left sides meet together in the middle, in a white longitudinal line.

Anatomists who preceded ALBINUS, divided this stratum into eight muscles, which they named from their attachments, and described these as distinct muscles, under the names Cephalo-Pharyngei, Pterygo-pharyngei, Mylo-pharyngei, Glosso-pharyngei, Hyo-pharyngei, Syndesmo-pharyngei, Thyro-pharyngei, and Crico-pharyngei.

Modern authors have divided these into three muscles only, under the names of Constrictor Pharyngis Superior, Medius, and Inferior.

As all these fibres have a similar insertion, and are subservient to a similar purpose; I shall describe them as one muscle only.

The upper part of the Constrictor Pharyngis takes its origin from the basis of the Cranium, from the Jaws, Palate, and Root of the Tongue; and it surrounds the upper part of the Pharynx; and the lower portion of the muscle arises from the Thyroid and Cricoid Cartilages of the Larynx, and passes forwards to meet with its fellow. This stratum of muscular fibres contracts upon the

bolus of food, and pushes it downwards into the gullet.

STYLO-PHARYNGEUS.

This muscle takes its origin from the Styloid process of the Temporal bone; and, passing downwards and forwards, is fixed into the side of the Pharynx, and into the back part of the Thyroid Cartilage of the Larynx.

This muscle elevates and dilates the Pharynx, and also the Thyroid Cartilage.

Engravings of the Mouth, Fauces, Pharynx, and Gullet.

J. D. SANTORINI's beautiful Plates, published by GIRARDI, of the Palate, Tongue, and Pharynx.
WATT's Anatomico-Chirurgical Views of the Mouth, Larynx, and Fauces. London, 1809.
BLEULAND de Sana et Morbosa Oesophagi Structura.
My Thesis de Dysphagia. Edinb. 1797.

Authors on the Muscles described in the last Section.

ALBINI Historia Musculorum.

COURCEILE'S Description of the Muscles of the Face.

J. D. SANTORINI has published a good Description of the Muscles of the Face.

MORGAGNI in his Adversaria Anat. has described with much care the structure of the Tongue, and of its Muscles.

Engravings of the Muscles of the Face.

Engravings of the Muscles of the Face have been published by the Authors above named, who have described the Muscles of the Face and Neck.

DR P. CAMPER, in his book on the Connexion between Anatomy and the science of Drawing, &c. has represented the Muscles of the Face as thrown into action by the different passions.

LANCISI, Anatomia per uso et intelligenza del disegno, ricercata non solo su gl' ossi, e muscoli del corpo humano, ma demonstrata ancora su le Statue Antiche piu insigne. Roma, MDCXCI. Fol.

J. D. SANTORINI'S Plates of the Muscles of the Face, Palate, Tongue, and Pharynx, published after his death by GIRARDI, are well worthy of the attention of the reader.

In the celebrated picture of the Last Judgment, by MICHAEL ANGELO, there are many wonderful specimens of expression.

The Groupe of the Laocoon affords the finest specimen extant; illustrating the effect of bodily pain upon the expression of the face, and indeed of the whole body. See the beautiful description of this Groupe, by VISCONTI, in his Account of the Statues, &c. in the Museum of Bonaparte.

CHAPTER IV.

SECT. I.

OF THE ABDOMEN.

THE Abdomen is that part of the body situated between the Chest and Pelvis. *

The Abdomen is bounded behind by the spine and muscles of the loins, at its sides and in front, by muscles, which therefore have been called Abdominal Muscles.

Above, by the muscle called *Diaphragm*; and below, by the bony circle which forms the upper aperture of the Pelvis.

In order to describe more accurately the situation of the different bowels included within the Abdomen, anatomists have divided it into certain regions or compartments, by lines. They draw one line from the Cartilage of the eighth rib of one side, to the Cartilage of the same rib of the opposite side; the space above the middle of

* I have omitted the word *cavity*, because there is no cavity of the Abdomen; for the Parietes of the Abdomen, and their contents, are in immediate contact, and constantly act and react upon each other.

which line, viz. in the angle made by the meeting of the Cartilages of the Ribs with the Stomach, has been called the EPIGASTRIC REGION; and the spaces on each side of that region the HYPOCHONDRIAC REGION.

They draw another line across the under part of the belly, between the anterior spinous processes of the Ossa Innominata.

The middle space above that line has been called the UMBILICAL REGION, and the lateral spaces the LUMBAR REGION; and the middle space below that line has been named the HYPOGASTRIC REGION, and the lateral spaces the ILIAC REGIONS.

SECT. II.

OF THE MUSCLES OF THE PARIETES OF THE ABDOMEN.

In the fore and lateral parts of the Parietes of the Abdomen there are three distinct strata of muscles; which being subservient nearly to the same purpose, I shall describe in the order in which they present upon dissection.

Of the Superficial Fascia.

Upon removing, with care, the skin of the belly, a thin fascia, or rather membrane, presents itself, which has been said by some to take its rise only from the inferior part of the tendon of the External Oblique Muscle, and has been described by CAMPER.

It rarely exhibits a fibrous appearance in the adult; and the fibres, when distinct, pass in a transverse direction with respect to the Abdomen. These fibres do not resemble tendinous fibres, being neither to the eye glistening, nor communicating to the touch the same dense feeling as tendon.

This membrane is proportionally thicker in the fœtus.

This fascia, which has always appeared to me to consist chiefly of condensed Cellular substance, covers the Spermatic Cord and round ligament of the Uterus, and also some of the Inguinal glands of the upper and under cluster; and may, in some subjects, at the upper part of the thigh, be divided into layers, between which some small Lymphatic glands are placed.

In a few cases, it may be readily traced for six or eight inches down the thigh.

This membrane, in some cases of Scrotal Hernia, attains a very considerable thickness; in others, it adheres so intimately to the Hernial Sac, that it is impossible to separate the one from the other.

Of the Costo-abdominalis, or *External Oblique Muscle of the Abdomen.*

This muscle originates by eight, sometimes by nine heads, which are in some measure like to right angles, from the eight or nine lowest ribs, and not at a great distance from the cartilaginous parts of the ribs.

The upper head adheres to the origins of the Serratus Anticus Major, and the lower to the Latissimus Dorsi.

All the heads adhere to the neighbouring Intercostal muscles.

The different heads of the Oblique muscle are greater in breadth than in thickness.

The fibres of the muscle proceed obliquely forwards and downwards, and terminate in a thin tendinous Aponeurosis.

The upper part of the muscle passes transversely across the body, and is connected by its tendon to the lower part of the larger Pectoral muscle. Where the tendon of this muscle is united with that of the subjacent muscle, there is a curved white line visible, which has been called Linea Semilunaris.

The tendons of the External Oblique muscles of opposite sides unite with each other, and form a distinct white line in the middle of the body, which extends from the Cartilago Ensiformis to the Pubes. The Linea Alba has therefore been described as the place where the one External Oblique muscle is inserted into the other.

The larger fibres of the tendinous Aponeurosis attached to the lower portion of the External Oblique muscle, descend obliquely inwards and downwards; are disposed in a parallel manner in respect to each other; and between these there is a much thinner tendinous substance.

The larger tendinous fibres of the External Ob-

lique muscle are united together by means of many thin tendinous fibres, which take their rise from the Crural Arch.

These smaller connecting fibres are by no means equally manifest in every instance, being in some persons very small and flattened; but in others, distinct, thick, and rounded cords; and, in Hernia, sometimes become very large, and make a distinct impression on the Hernial Sac. *

Sometimes these connecting fibres are entirely wanting.

The under part of the tendon of the External Oblique muscle, stretched between the anterior superior spinous process of the Ilium, and the Symphysis Pubis, is thicker and stronger than any other part of it, and somewhat rounded, especially towards the Ossa Pubis, and has been described under the name of Poupart's Ligament; and more lately it has been called by anatomists *Crural Arch*, as it extends over the flexor muscles, great blood-vessels, and nerves of the thigh.

This under part of the tendon was formerly supposed to be attached only to the anterior superior spinous process of the Ilium, and the ligament of the Symphysis Pubis.

Mr GIMBERNAT has, however, shown, that the tendon is doubled inwards, and forms a canal for the Spermatic Cord in the male, and for the Round Ligament of the female Uterus.

* *Vid.* Plates of Inguinal Herniæ by CAMPER.

Poupart's Ligament, or the Crural Arch, is sometimes *double. I have seen two such ligaments on each side.* When that is the case, the one ligament is generally fixed about a line above the tubercle of the Pubes, and the other is found in its usual situation.

About an inch, or a little more, from the Symphysis Pubis, the tendon of the External Oblique muscle is generally divided into an upper and under column; but in some instances, the division takes place at a greater distance from the Symphysis Pubis. Between the tendinous columns, which are connected at the upper part by a few transverse tendinous fibres, a space intervenes, which is somewhat of an oval figure, which has been commonly called the Spermatic Ring; but this term conveys an inaccurate idea of the form of this aperture, and it should be called INGUINAL or ABDOMINAL APERTURE, and with the addition of the word *Under*, to distinguish it from the *Upper* INGUINAL or ABDOMINAL APERTURE.

Through the UNDER ABDOMINAL APERTURE, the Spermatic Cord passes; and in the female, the round ligament of the Uterus: and there is no direct opening into the Abdomen, the passage being shut up by the Internal Oblique, and Transverse muscles, and by the Fascia Transversalis.

The UNDER ABDOMINAL APERTURE in the male is somewhat curved above, angular below,

and directed obliquely downwards and inwards; and the sides of it are thicker than its upper or under part, being formed of the straight fibres of the tendon; whereas, the thinner tendinous substance, which connects the thicker fibres of the tendon, forms the upper part of the aperture. In the male, the UNDER INGUINAL APERTURE is about an inch in length; but in the female, it is rather longer, and also narrower.

To the upper column of the tendon of the External Oblique muscle, which forms the UNDER ABDOMINAL APERTURE, a thin portion of tendon is fixed, which passes downwards, and is attached to the Gluteus Maximus and Triceps Adductor muscle of the thigh, which has also been observed by CAMPER, and represented by him in one of his excellent plates of Hernia: this, by embracing the Spermatic Cord, proves in some measure a barrier against Hernia.

The upper part of the tendon of the External Oblique muscle, passes obliquely downwards and inwards, and is in part fixed to the ligament of the Symphysis Pubis of the same side, and also to that part of the ligament of the opposite side, decussating in its course the tendinous fibres of the External Oblique of the opposite side, so that some of the tendinous fibres of the right side terminate in the left Os Pubis.

The portion of the tendinous Aponeurosis forming the under part of the UNDER ABDOMINAL

APERTURE, is folded under the Spermatic Cord, and round ligament of the female; and passes inwards, and is inserted into the Spinous process of the Os Pubis, and Linea Ilio-pectinea, (a term used by my Grandfather in his Osteology), for the space of about an inch, or a little more.

Some have described this insertion of the under column as a distinct ligament.

In the erect posture, this part of the tendon of the External Oblique is placed almost horizontally, and is much deeper than the upper part of the tendon.

The upper and under parts of the tendon of the External Oblique muscle are widely different in another respect: The upper and outer is a thick rounded cord, extending from the spine of the Os Ilium to the tubercle and symphysis of the Pubes: the under is reflected backwards and inwards, and is extended over the femoral blood-vessels; and its posterior edge is very thin.

The Crural blood-vessels, Lymphatics of the inferior extremities, the internal Iliac and Psoas muscles, and the protruded bowels, in cases of Crural Hernia, pass behind the Crural Arch.

ILIO-ABDOMINALIS MEDIUS, or *Obliquus Abdominis Internus.*

This muscle arises from the spine of the Ilium, by a thin tendon common to the Serratus Posticus Inferior, and the Latissimus Dorsi; from the

three lowest Lumbar Vertebræ, and from the inner side of the Crural Arch. From these origins the fibres describe a radiated course upwards; and at the Linea Semilunaris, the tendon is fixed to the muscle, which divides into two layers; one of which joins that of the External Oblique, and forms the fore part of the sheath of the Rectus muscle; the other joins that of the Transverse muscle, and goes behind the Rectus, forming the posterior part of the sheath, till about half way between the Navel and Os Pubis. This muscle is fixed into the Linea Alba, the Cartilages of the False Ribs, and the Cartilago Ensiformis.

Lumbo-abdominalis, or *Transversus Abdominis.*

This muscle arises from the inner side of Poupart's Ligament, from the back part of the spine of the Ilium, from the inner surface of the six lower Ribs, and from the transverse processes of the four uppermost Vertebræ of the Loins.

The fibres of this muscle run transversely across the Abdomen, and are fixed into the Linea Alba and Ensiform cartilage of the Sternum.

Sterno-pubalis, or *Rectus Abdominis.*

This muscle arises from the Cartilages of the three undermost True Ribs, and extremity of the Breast bone. It forms a broad flat muscle, which is disposed in a parallel manner to the Linea Al-

ba: and it is at length fixed into the fore and upper part of the Os Pubis.

In its course to the Umbilicus, three tendinous lines pass across it; and between the Navel and the Ossa Pubis, there is a portion of tendon which extends only half way across the muscle.

PUBIO-SUB-UMBILICALIS, or *Pyramidalis*.

This muscle is named Pyramidal from its shape. The base of the pyramid is connected to the upper part of the Symphysis Pubis; and the apex of it is fixed into the Linea Alba, about half way between the Navel and Ossa Pubis.

The muscles of the Parietes of the Abdomen, besides compressing the hollow bowels included within them, and also the bowels of the Pelvis expelling their contents, tend to bend the body to a side, and draw the Ribs directly downwards; or, if the Thorax be fixed, the Pelvis is drawn upwards: by their continued action, the heels may be thrown over the head. It may be proper to add, that the Internal Oblique muscle of the right side cooperates in its action with the External Oblique of the left side.

The tendinous sheath of the Sterno-pubalis preserves that muscle in its proper place when the body is bent.

Anatomical Description of the Internal Parts in the Male.

Upon removing the Peritonæum which lines the Abdominal, Iliaco-Internus, and Psoas Muscles, the Umbilical Arteries changed into ligaments, and the Urachus, come into view. The Spermatic vessels are also exposed; and these sweep along the brim of the Pelvis, over the surface of the Iliacus Internus muscle; and, upon reaching the Upper Abdominal Aperture, the Vas Deferens is added. The Spermatic Cord, thus formed, then passes obliquely downwards and forwards, along the lower part of the Internal Oblique and Transverse muscles of the Abdomen in its course, receiving from the Internal Oblique the Cremaster muscle; and then, at the UNDER ABDOMINAL APERTURE, it suddenly forms an angle, which covers the insertion of the outer tendinous column of the External Oblique muscles into the Pubes, and then passes directly into the Scrotum.

This peculiar course of the Spermatic Cord has been very faithfully represented by VESALIUS, in the wooden plates affixed to his book, and also by ALBINUS. It was reserved for Mr ASTLEY COOPER, to detect and describe the UPPER ABDOMINAL APERTURE, which may be perceived by introducing the finger into the UNDER ABDOMINAL APERTURE, and, by pushing it up-

wards in the direction of the Anterior Spinous process of the Ilium, the borders of the UPPER APERTURE may then be perceived about an inch nearer to the Anterior Spinous process of the Os Ilium, than the UNDER APERTURE, the borders of which are in part formed by the Internal Oblique and Transverse muscles, and by the Fascia Transversalis.

The Inguinal Canal of the adult follows an oblique course, and about an inch intervenes between the UPPER and UNDER APERTURES of that Canal. The upper part of this Inguinal Canal, called UPPER ABDOMINAL INTERNAL APERTURE, is formed by the Transverse and Internal Oblique muscles, and the Fascia Transversalis; and the EXTERNAL or LOWER ABDOMINAL APERTURE, is formed by the disunion of the tendon of the External Oblique muscle.

In the fœtus, the Spermatic Cord passes *directly* through the Parietes of the Abdomen.

The internal or posterior part of the Crural Arch is always distinct. It is marked by a white line in the tendon, which extends from the Anterior Spinous process of the Os Ilium to the Linea Ilio-pectinea, and feels like a tense Cord when the limb is extended; but, when the thigh and leg are raised to nearly a right angle with the body, the internal edge of the Crural Arch is thrown into a state of relaxation; which position is favourable, not only to the displacement of the bowels, but also to the replacing the bowels when

protruded. A continued tendinous membrane lines the internal parts; for the internal or posterior margin of the Crural Arch is intimately interwoven with the tendinous fascia which covers the Iliacus internus and Psoas Magnus Muscles, which is connected to the Crista of the Ilium, to the Linea Ilio-pectinea and Ligament of the Pubes; also with that fascia, or rather membrane, which covers the transverse muscles, as far as that part of the thigh where the anterior Iliac Artery and Vein emerge from the Pelvis: Thus, the Crural Arch is firmly bound down, and the bowels can be protruded only through the Crural aperture.

Of the Crural Sheath.

A part of the Iliac Fascia passes behind the Crural vessels, and is firmly united to the Pubal part of the Fascia lata, forming the posterior part of the Crural sheath; and the Crural vessels are covered anteriorly by the Fascia Transversalis, Crural Arch, and Cellular substance. Thus, the beginning of the Crural Sheath is formed, and the above Fasciæ unite at the sides, and form the lateral portions of the sheath.

The Anterior Iliac Artery and Vein are closely enveloped by the same kind of Cellular sheath as the other Arteries and Veins of the body; which sheath is firmly fixed to the inner edge of the Crural Arch by short Cellular threads; and be-

tween the Artery and Vein there is a distinct division.

Of the Crural Aperture.

On the side of the Anterior Iliac Vein, next the Pubes, there is an aperture called Crural, somewhat of an oval figure, and considerably larger in the female than in the male, which is generally filled by a Cribriform membrane, through which the Lymphatics of the inferior extremities enter the Pelvis, and sometimes, though very rarely, by a membrane, which has somewhat of a ligamentous nature, and sometimes by Lymphatic Glands, and, according to Mr COOPER, also by a portion of the Fascia Transversalis.

On the fore part of the CRURAL APERTURE, the Crural Arch is placed behind the Pubes; and on the Pubal side of it, the thin border of the internal part of the Crural Arch, sometimes called GIMBERNAT'S Ligament, or the third insertion of the external oblique muscle, by Mr ASTLEY COOPER.

There is a considerable difference as to the size of this aperture in the male and female. It is considerably larger in the latter, * owing to the greater size of the bones of the Pelvis, to the

* The Plates in my Treatise upon the Morbid Anatomy of the Gullet, Stomach, and Intestines, clearly point out the distinctions between the size of the Crural Aperture in the male and female.

smaller size of the Iliacus Internus and Psoas Muscles, and chiefly, as I discovered, to the greater narrowness of the internal part of the Crural Arch, fixed into the Pubal part of the Linea Ilio-pectinea.

Of the Fascia Transversalis.

The attention of Anatomists has been lately drawn to a thin Fascia, * which is seen upon removing the Peritonæum lining the Abdominal Muscles, which was discovered by Mr COOPER. † This Fascia lines the under part of the transverse muscle of the belly, is connected with the inner or posterior part of the Crural Arch, and then ascends for four or five inches upon the Transversalis Muscle of the Abdomen, upon the surface of which it is gradually loſt.

This fascia serves two important purposes: it shuts up the direct passage into the cavity of the belly, behind the under Abdominal aperture, and by dividing into the Ilial and Pubal Portions, forms in a great measure the upper Abdominal aperture. This Transversalis fascia is so dilatable, that in Herniæ of some standing, the upper aperperture is nearly opposed to the under aperture.

* I have described this Fascia Transversalis, and Upper Abdominal Aperture, as in the parts dissected, which Mr ASTLEY COOPER sent to me.

† Mr COOPER has acknowledged, that, in some instances, it is merely condensed Cellular substance.

There are some fibres from the under column of the External Oblique muscle, which strengthen the back part of the Inguinal Canal.

The Diaphragm and Levator Ani should perhaps be described in this place, as they have a great effect upon the bowels of the Abdomen.

But as the Diaphragm cannot be seen until the Viscera of the Abdomen are removed, I shall describe it under the head of the Muscles of Respiration.

The Levator Ani I propose to describe under the head of Muscles proper to the Anus.

As the Fascia Lata of the thigh is intimately interwoven with the Fasciæ of the Muscles of the Abdomen, and as the relation and connexion of these Fasciæ is necessary to the explanation of the nature of HERNIÆ, I have subjoined a description of the Fascia Lata of the thigh.

Of the Fascia Lata of the Thigh.

The Muscles of the Thigh are covered by a strong tendinous aponeurosis, called Fascia Lata, which takes its rise from the outer rounded portion of the Crural Arch, from the Spine of the Ilium, and from the Pubes.

Beneath the Crural Arch, (supposing the body to be erect), an oval-shaped depression may be perceived on the fore, and rather on the inner part of the thigh, on the surface of the Pectineus

muscle, which is bounded by a well-defined tendinous border, except at its inner edge.

The situation of the above-mentioned depression merits notice, as marking the situation of Crural Hernia. In the Fascia Lata, there is an aperture through which the Vena Saphena Major passes, to join the Femoral Vein, the borders of which aperture are covered by fat, cellular substance, and Lymphatic Glands. The Fascia Lata has been described as being composed of two distinct portions: one of which covers the upper and outer part of the Thigh, and is connected with the larger share of the Crural Arch, between the Anterior Spinous process of the Os Ilium and Tubercle of the Pubes, and may be called *Ilial* portion; and the other, which arises from the Pubes, *Pubal* portion. Where the Iliac part of the Fascia Lata ceases to be united to the Crural Arch, it forms a fold of the shape of a sickle, the concavity of which looks downwards and inwards; which was first accurately described by Mr BURNS of Glasgow, and called, by him, the Falsiform Process of the Fascia Lata; and this covers that portion of the Femoral Artery and Vein which is found immediately under the Crural Arch, and the under part of the Iliacus Internus and Psoas muscles.

The other, or *Pubal part*, which is thinner than the *Ilial portion* of the tendon, arises from the Pubes, and covers part of the Pectineus and Triceps muscles, and is united with the *Ilial* part

beneath the Vena Saphena Major, where that Vein joins the Femoral Vein.

Of the Blood-vessels which are proper to the Muscles of the Parietes of the Abdomen, and of the Situation of the neighbouring Blood-vessels in respect to Inguinal and Crural Herniæ.*

The Parietes of the Abdomen are supplied with blood from several sources; from the *Epigastric Artery*; from the *Arteria Circumflexa Ossis Ilii*; from the *Lumbar Arteries*; and sometimes from the *Obturator Arteries*.

The situation of the Arteries and Veins, in respect to the Hernial Tumour, in an especial manner claims the attention of the Surgeon.

The Epigastric Artery generally arises from the Anterior Iliac Artery, and passes behind the Spermatic Cord, on the side of the Upper Abdominal Aperture, next the Pubes, in its course to the posterior part of the Rectus muscle. The Epigastric artery must therefore be first behind, and then on the Pubal side of the most common kind of Inguinal Herniæ.

Camper, in his excellent Observationes Pathologicæ, has accurately described the situation

* From a desire of rendering these outlines still more useful to the Surgeon, I have inserted in this place a detailed account of the situation of the blood-vessels of the Parietes of the Abdomen.

of the *Epigastric Artery and Vein*, in respect to the Hernial Tumour; and has added, that from the duration of the disease, these vessels are pushed nearer to the Pubes; '*in Herniis inguinalibus,* '*Arteria et Vena Epigastrica versus pubem a* '*prolapsis Intestinis compelluntur.*'

But *the Epigastric Artery* is also sometimes situated on the opposite or Ilial side of the Tumour, as has been observed by DESAULT, CHOPART, SABATIER, CAMPER, and ROUGEMONT.

The Epigastric Artery, in cases of Crural Hernia, appears about half an inch nearer the anterior superior spinous process of the Ilium, than the neck of the Sac, then passes obliquely inwards and upwards, to the Rectus muscle of the Abdomen.

The Epigastric Artery does not always take its rise from the same part of the Anterior Iliac Artery within the Pelvis.

I have seen the *Epigastric Artery and Internal Circumflex of the Pelvis* come off from *the Anterior Iliac, by a common trunk within the Pelvis, and very near to the Crural Arch.*

The Epigastric Artery sometimes arises from the *External Pudic Artery;* I have also seen it arising from the *Arteria Profunda Femoris.* In some cases, a branch of the *Epigastric Artery* passes through the Inguinal Canal, and anastomoses with a small branch sent off from the Femoral Artery.

When the *Epigastric Artery* takes its usual origin from the anterior Iliac Artery, its smaller branches, in some cases, pass along that part of the Crural Arch called GIMBERNAT's Ligament, in their course to the Symphysis Pubis.

I have a specimen in which the Epigastric Artery takes its rise from the Obturator, and passes upwards and inwards to the Rectus muscle.

Besides the *Epigastric Artery*, there is another artery which is in danger of being wounded in performing the operation for Crural Hernia.

I allude to the *Obturator Artery* which commonly arises from the posterior Iliac Artery; but sometimes, as in fig. 1st, Plate XV. takes its origin in common with the Epigastric Artery from the anterior Iliac.

The trunk common to the *Obturator* and *Epigastric Arteries*, is sometimes a quarter of an inch in length; in other instances, it measures from an inch to an inch and a half; and I have met with it of all intermediate lengths.

If the common trunk be only a fourth of an inch long, the *Obturator Artery* runs on that side of the sac, which is next to the anterior Spinous process of the Ilium, and cannot be displaced, being firmly bound down by cellular substance; and therefore, cannot be injured, in that kind of Crural Hernia in which the displaced bowels are lodged within the sheath of the Lymphatic vessels, by dividing that part of the Crural Arch

next the Pubes, in the manner recommended by Mr GIMBERNAT.

On the other hand, it frequently happens, when *the Obturator* arises in common with the Epigastric Artery, that a third branch, nearly of equal size with the *Obturator*, takes its rise from the common trunk. This may be called the Artery of the internal part of the Crural Arch; for it runs on the inner side of the Crural Arch, passes across GIMBERNAT's Ligament, and, when it reaches the Symphysis Pubis, then divides into a number of small branches which are distributed upon the inner side of the Symphysis Pubis.

It also merits mention, that a small artery, or two or three small branches, are sometimes sent off from the *Obturator*, in its course from the common trunk to the *Foramen Obturatorium*, which are distributed upon that part of the Crural Arch, called GIMBERNAT's Ligament, and which may be divided in performing the operation for Crural Hernia, as recommended by Mr GIMBERNAT.

When the trunk common to the *Obturator* and *Epigastric Arteries* is of an inch, or an inch and a half in length, the *Obturator Artery* is then situated between the Symphysis Pubis and the Hernial Sac, and sometimes follows the same course as that part of the Crural Arch called GIMBERNAT's Ligament; of which I have seen several examples.

Mr JAMES WARDROP is, I believe, the first

who has described such a distribution of arteries in the case of Crural Hernia. In that instance, the *Obturator Artery* arose from the same trunk *as the Epigastric Artery*, and then passed on the Pubal side of the neck of the Hernial Sac, and described a semicircle around the neck of the Sac.

Baron HALLER, LIEUTAUD, RICHTER, and MURRAY of Upsal, have described such an unusual origin of *the Obturator Artery*; but do not make mention of the proportion of cases in which it occurs.

I have paid a good deal of attention to this department of anatomy: In my observations on Crural Hernia, (published in 1803), I have stated, that I had not observed such a deviation from the usual distribution of the arteries *in above one of twenty-five or thirty cases*; and according to subsequent observation, such a distribution of arteries occurs in about one of twenty cases. I have also observed, that the short division is as common as the longer; and as the Obturator Artery is only in danger of being divided by GIMBERNAT's operation in the latter case, (indeed Mr COOPER asserts, that he had never met with the Obturator Artery passing around the neck of the Hernial Sac), *hence such an unusual distribution of the Obturator Artery does not form so material an objection to the operation for Crural Hernia*, performed according to the method of GIMBERNAT, as has been supposed.

There is still another variety as to the distribu-

tion *of the Epigastric and Obturator Arteries.* These arteries, in some cases, come off from the Anterior Iliac Artery by separate trunks; and *the Obturator Artery passes around that part of the Crural Arch called* GIMBERNAT'S *Ligament*, and is attached to it by cellular substance. When this happens, the Obturator Artery, by the descent of a portion of the Intestine through the Crural Ring, is pressed upon the very part of the Crural Arch divided by GIMBERNAT, in his operation for Crural Hernia.

I have seen *the Obturator Artery* sent off from the external Iliac Artery, about an inch and a half above, and in others, about an inch below *the Epigastric Artery*; and in other cases, even on the outer side of the Pelvis, from *the superficial Femoral Artery*; in which case, the artery ascends along the Pectineus Muscle, and enters the Pelvis, at the Crural Aperture. The artery in this case is placed behind the Crural Hernia.

I have made particular mention of all the varieties as to the origin and course of the Epigastric and Obturator Arteries, and of their branches, which have fallen under my observation, as these arteries are of considerable size, and when divided in the time of performing the operation for Crural Hernia, have poured out so much blood as has proved fatal; for on account of their deep situation and retraction, it is extremely difficult to secure these by Ligature.

Even wounds of the smaller branches of the Epigastric Artery sometimes prove fatal.

Dr CARMICHAEL SMYTH * has related the histories of two such cases, and makes mention of other similar cases, which were communicated to him, in which the patients lost their lives, by a wound made in the Epigastric Artery, in performing the operation of tapping for the dropsy in the belly.

There is another artery, which, from a variety as to its mode of distribution, may be divided in performing the operation for the Crural and Inguinal Herniæ.

I allude to the *Arteria Circumflexa Ossis Ilii*, which takes its rise within the Pelvis, from the anterior Iliac Artery, and opposite to the Epigastric Artery. I have seen a branch of this artery nearly as large as the Epigastric, pass under the Crural Arch, about two inches from the Symphysis Pubis; and it then divided into branches, which were distributed upon the Symphysis Pubis, the fat and skin over the Crural Arch, whilst other small branches were distributed upon the Ilial portion of the Fascia Lata of the Thigh.

The peculiar course of the veins also merits attention. A plexus of veins is sometimes placed on GIMBERNAT's Ligament; a good deal of blood may be lost by wounding these, especially as they run on the inner side of the Crural Arch;

* *Vid.* London Med. Communicat.

and therefore the bleeding could not be stopped by pressure.

The Obturator Vein generally accompanies the Obturator Artery, and therefore may be divided at the same time as the artery, in performing the operation for Crural Hernia, as recommended by GIMBERNAT.

Mr A. BURNS of Glasgow, lately showed me a case of Crural Hernia, in which a large vein passed along the inner part of the Crural Arch, and received the Epigastric Vein. In this case, if the division of the Crural Arch had been made directly upwards, as has been recommended, that large vein must have been divided, and, on account of the size of the vein, a great quantity of blood might have been lost.

Such is the account of the parts concerned in Hernia, * which I have, for several years past, delivered in my Courses of Lectures. But notwithstanding all that has been lately written upon the anatomy of the parts concerned in the Inguinal and Crural Herniæ, there is a branch of the subject which has not yet been explained to the Medical world—I mean the gradual formation of the *Inguinal Canal.*

Having found that Mr ALLAN BURNS, of Glasgow, had devoted a great share of attention

* I have omitted, in this book, the inferences deduced from the preceding account; for these I beg leave to refer the reader to the Morbid Anatomy of the Gullet, Stomach, &c.

to this branch of the subject, I requested of him to favour me with his observations; with which request he readily complied, and, by his permission, I have inserted these in his own words.

"When we remove carefully all the Cellular Membrane from over the External Oblique Muscle, we still find the muscular fibres covered by an Aponeurotic expansion, which, toward the lower part of the belly, branches off into two processes. One plate we trace descending along the thigh, investing the Glands, and forming the subcutaneous Fascia; the other turns inwards, and incorporates itself with the fatty ligamentous substance found above the Pubes; adhering, in males, to the Ligamentum Suspensorium Penis; and in females, to the Ligament of the Clitoris. Camper, the celebrated Dutch anatonist, adds, "et involucrum dat musculo Cremasteri." Mr Astley Cooper also describes most accurately the Fascia, which he represents as originating from the aponeurosis of the Oblique Muscle, and investing the Tunica Vaginalis, forming for it a sheath. This Fascia is naturally not very strong; but in Hernia, it is sometimes immensely thickened. In one specimen of this disease in my possession, it is fully a quarter of an inch thick.

"When we divide longitudinally the sheath of the Cremaster or Camper's Fascia, we bring into view the Tunica Vaginalis, covering the Spermatic Cord; and if we trace the latter up towards

the Abdomen, we lose it where it enters the lower orifice of the Inguinal Canal.

"In the fœtus, or new born male, we find that the tendon of the External Oblique muscle, at its inferior and anterior part, separates into two pillars, which leave between them an irregular opening, through which the cord passes. One of these pillars runs below the cord, the other above it. Both pillars tend obliquely downward and forward, inclining toward the crest of the Pubes, where one is completely lost, the other in part implanted. That fold which passes below the cord is completely implanted into the tough ligament which covers the tubercle of the Pubes. The other pillar, when it reaches the Pubes, separates into two bands; the posterior, or deeper-seated, is inserted along with the lower pillar into the tubercle of the Pubes, and even extends to the opposite side. The other, and by far the most important fillet, winds obliquely inward; then bending backward between the Penis and the Cord, it at last incorporates itself with the Fascia, covering the heads of the Triceps Longus, the Gracilis and Flexor Muscles of the leg; and in some cases, it can be traced much farther, and reaches even to the tendon of the Glutæus Maximus, to which it is attached. This slip from the upper pillar of the Canal, is always inseparably joined to the Fasciæ covering the Cremaster; indeed, it may perhaps most properly be described

as a part of CAMPER's Fascia, attached to the Ring. I thought that this structure had not been noticed by any author. I find, however, that it has not escaped that indefatigable anatomist CAMPER, who delineates it very accurately in his plate. It is easiest detected by slitting up CAMPER's Fascia, by which I mean the sheath of the Cremaster, till we come near to the Ring. When we have done this, if we then insinuate the point of the finger into the lower orifice of the Canal in the adult, or Ring in the child, we find that we are by this fillet prevented from carrying the finger toward the Pubes.

" This part of the Canal merits peculiar attention; for whoever is ignorant of the position and connexion of this production from the upper pillar of the Ring, can possess only a very confused notion of its action in disease.

" When I shall have stated the anatomy of the Groin in the young subject, and have pointed out the changes which take place on these as life advances, I shall then have occasion to notice the effect of this fillet in preventing the formation of Hernia; and also, we shall see that when a protrusion has actually taken place, it has a considerable share in preventing reduction.

" When we have examined in the very young subject, the structure of the external orifice, through which the cord passes, we have seen all that is most worthy of notice, for in the very early part of life, the Inguinal Canal is not form-

ed. In proof of which, take a new-born male, in whom the Tunica Vaginalis communicates with the cavity of the Abdomen, and make a puncture into the former, through which one of the blades of a pair of scissars is to be introduced, and passed into the Belly, then all that portion of the Tunica Vaginalis, which is above the puncture, is to be snipped through. By doing this, we lay the Abdomen and Tunica Vaginalis into one, and we at the first glance perceive whether the cord, at this early period of life, passes in an oblique direction between the muscles and Transversalis Fascia.

"I have never observed the cord in any obvious degree *oblique* in its course; in an infant at birth, it runs *in a straight line* from the Psoas Muscle to the bottom of the Scrotum.

"It passes through *a mere aperture.*

"When, however, we take a subject even a month old, and treat it in the same way, we find then *a very apparent obliquity* in the course of the cord. As, however, it is very rare to meet with an infant of that age, in whom the Tunica Vaginalis remains pervious, we may, where its Canal is obliterated, by slitting up CAMPER'S Fascia, and entering the blade of a sharp-pointed pair of scissars into the lower outlet of the Canal, pass it up till it appears in contact with that part of the peritonæum which invests the cord at that spot where it passes from the Abdomen. If we divide completely what is between the blades,

we expose fairly the *degree of obliquity of the Cord.*

"If we examine, in a similar way, subjects of different ages, we find that the older they become, till they arrive near the age of puberty, *so much the longer does the Inguinal Canal become.*

"It may here be worth while to inquire how the Canal comes to be formed, and what changes take place on the neighbouring parts. As I have already mentioned, the upper and lower openings of the Fœtal Ring are *opposite to each other*, and so very little distant the one from the other, that there is hardly a palpable space between them. The Ring is placed just in contact with the tubercle of the Pubes. From this fact, it must at first sight appear, that the lower outlet is in the Fœtus, in the same spot which it is afterwards to occupy in the adult. In proportion, therefore, as the Fœtal Ring is changed into the Adult Canal, it is the *internal orifice* which changes its position; it is the upper opening which mounts toward the Spine of the Ilium. We may from this very readily understand, that it is *from the gradual extension of the Transversalis Fascia*, in that direction, that the Cord comes to be enclosed in a Canal. A very simple contrivance gives a very clear idea of the manner in which the Inguinal Canal is formed. Let any one take two slips of paper of the same length, and cut two small holes in the centre of each; let him then lay these holes opposite to each other, and pass through them a quill

or pencil-case. When he has done this, he has a very good plan of the state of parts about the Groin in the Fœtus. If he now hold the papers opposite him, and then pull to a side the one nearest to himself, he will find, that by doing this, he comes to lay the quill between the pieces of paper in the same way that the Spermatic Cord, by the extension upward and outward of the Internal Orifice of the Ring, comes to be lodged in a long Canal. And he will also see, that the length of the Canal must vary according *to the greater or less extension of its posterior side.* Many have also been puzzled to comprehend how the Epigastric Artery can bear precisely the same relation to the Cord in the Fœtus and Adult, seeing the difference which has taken place in the relative position of the Internal Orifice of the Canal. This difficulty only occurs to those who do not properly understand the mechanism of the parts. One who has made himself acquainted with the real structure, is never difficulted in following the changes. If the state of parts in the very young subject be known, and if the surgeon have examined those at an advanced period of life, by comparing the one with the other, he has at once unfolded to him the mode in which the Fœtal Ring is changed into the Adult Canal. He is taught, that it is a natural consequence *of the oblique extension of the Transversalis Fascia* toward the Spine of the Ilium. He sees that, in proportion to the degree in which the posterior side of

the Canal overlaps the anterior, so must the length of the Canal vary. If he take a just and comprehensive view of these parts, he will be able to see, in the structure, a wise provision of Nature to prevent protrusion at the Groin, and he will also be led to deduce some pathological inferences from the data before him. He will be prepared to understand why Inguinal Hernia is much more frequent in young than in old subjects; why it is often cured in the former, and seldom in the latter; and why in the one it is a more dangerous affection than in the other.

"In the very early period of life, the cord, as we have just seen, passes through a *mere aperture*; and besides, there is an open communication between the Tunica Vaginalis and the Belly. From these circumstances, therefore, a portion of Gut is forced down along the Cord, forming Congenital Hernia; or, if the Tunica Vaginalis be obliterated, a new Peritoneal Sac passes through the Ring by the side of the cord. As, however, the parts are more dilatable in the young than in the old person, so is Hernia, *cæteris paribus*, more readily reducible in the former, and consequently less dangerous. The Gut, in the first instance, in the young subject, passes through a *simple Ring;* but if the Hernia be allowed to remain, then in many cases the Upper Orifice, ascending toward the Spine of the Ilium, as it ought to do, comes in the end to lodge both the Hernial Sac and the Spermatic Cord in a com-

plete Canal; and this will probably be found to be the reason why surgeons believe that Hernia does often take place along the Canal. They see a Herniary Tumour in advanced age, lying in the oblique course of the Canal; but they forget to inquire when the protrusion took place, and what was the original appearance of the Tumour.

" Were they to trace their cases to their origin, they would most probably ascertain, that, in the first instance, the Hernia had appeared in infancy; that it had been *less oblique at the beginning, but imperceptibly became more and more so.* I speak from what I have seen in several instances. Among a considerable number of patients, in whom the Hernia was lodged in the Canal, and of some of which I have casts, I have uniformly, by applying to the friends, ascertained that the Rupture had taken place in infancy, and had slowly assumed the oblique direction. Some of the nurses have even said, that when, immediately after birth, they attempted to return the Gut, they found that it had passed through a hole, about large enough to admit the tip of their little finger; but, when the child was older, they found it run more to a side.

" In the advanced stage of Hernia, the parts are brought into precisely the same state they were in when the disease began. In the Congenital Hernia, or in the common Inguinal Hernia taking place in a very young child, the Sac passes through *a mere aperture*; then, in time we have

seen, that, owing to changes which this opening undergoes, the Gut comes to be lodged in a *fully formed Canal*. This continues till the Tumour becomes large, when the posterior side of the Canal is, owing to the pressure, slowly absorbed; and again the upper and lower orifices are brought opposite to each other. Again, the Hernia resembles, in its appearance and course, the Incipient Tumour.

"If the view which I have given of the mode of formation of the Inguinal Canal be correct, it will lead to this conclusion, that we ought, in every case of Hernia in a young child, most sedulously to prevent the descent of the Gut, and, if possible, to return also the Sac, where it is not Congenital Rupture; for if we do this, we bid fair to cure the disease, by allowing of the *extension of the posterior side of the Canal along the Cord*. This observation leads me to a review of the influence which the different parts of the Inguinal Canal have in preventing the accession of Hernia.

"In the very young child, there is no security against Hernia, except what arises from the Cord filling the aperture through which it passes. This is generally sufficient; for the infant is exposed to few of the exciting causes of the disease.

"When, however, the child advances in years, in the course of its amusements, and afterward of its business, it is more and more exposed to the causes of Hernia.

"Nature has, however, wisely provided, that in proportion to the danger, the security should be increased. The posterior side of the Canal overlaps every day more and more the anterior side; consequently, when the canal is completed, any pressure against the posterior side, tending to produce Hernia, has *the effect of laying that side more firmly in contact with the Cord;* of forcing the latter steadily against the anterior side, where the fibres of the Transversalis and Internal Oblique muscles react upon it. Thus, a most perfect valve is formed; and where the posterior side of the Canal is fully extended, it is impossible that Inguinal Hernia can take place.

"I have already attempted to show, that where the Gut has passed down in infancy, it may, in the end, come to be lodged in a Canal; but this is very different from a Hernia passing along the Canal for the first time in an adult. By the overlapping of one side of the Canal over the other, Hernia is prevented from primarily taking place in the adult, by the internal orifice of the Inguinal Canal.

"Although, for the reasons above stated, Hernia cannot often, if ever, take place by the upper orifice of the Inguinal Canal; still, was there not some contrivance devised, it might happen, by bursting the posterior side of the Canal opposite the lower orifice.

"The posterior side of the Inguinal Canal is formed, as was first demonstrated by Mr COOPER,

by the Transversalis Fascia, which is thin and dilatable, and, therefore, independent of assistance, affords but a trifling barrier to protrusion. Nature has not, however, neglected this point; for, opposite to the inferior opening, she has strengthened the posterior side, by *a set of inflected fibres*, which arise, as described by CAMPER, from the folded in lower pillar of the Oblique muscle, and run upward, expanding over that portion of the Transversalis Fascia opposite to the lower outlet. This affords one security; but Nature seems peculiarly solicitous about defending this opening, and has therefore bound the two pillars firmly together, by cross slips, and made to arise from the upper one, a fasciculus of Fascia, which by winding round the top of the thigh, must, in these motions which would endanger the parts, be made closely to embrace the Cord, adapting thus, in a most accurate manner, the size of the lower outlet to the size of the Cord.

"We thus see, that, *by the posterior wall of the Canal, Inguinal Hernia is, in the adult, prevented from taking place through the upper orifice;* and that, by the peculiarity of the mechanism of the lower opening, *Ventro-Inguinal Hernia* cannot occur, except where, by violence, the posterior side of the Canal is burst, or the cross slips torn, by which the fillet from the upper pillar would come to lose its effect.

"When Hernia has taken place, the very objects which formerly had a tendency to prevent

its accession, are now so far changed in their action, that they present obstacles to the replacement of the Gut. If the Hernia has occurred in a young subject, where the Canal is not formed, or in an adult in whom the poſterior side is wanting, which is not a very rare malformation, then our only difficulty muſt depend on the action of the lower outlet. In this case, the cross fibres which bind the two pillars together, act on the Sac; and the fillet, from the upper pillar, embraces it closely, but not equally, in every direction of the limb. When the toes are rolled inward, and the thigh, on the affected side, pulled from the other, and turned backward, this fillet is sunk into the Sac, and retains it immoveably in its situation.

" This species of stricture may most readily be overcome, by moving the member in an opposite way; and, I believe, in knowing how to humour the parts in the Taxis, the great superiority of one surgeon over another consists. When, however, the rupture has taken place in infancy, and continued till the complete extension of the Canal is accomplished, then, besides this source of difficulty, there is also a source of embarrassment, arising from the reaction of the fibres of the Transversalis and Internal Oblique muscles upon the Sac, which occasion a species of stricture, in which bloodletting, warmth, and the relaxing the muscles by bending the body sideways, facilitate the reduction. The above remark applies to that

species of incarceration dependent on a narrowing of the internal orifice of the Canal."

SECT. III.

OF THE PERITONÆUM.

THE Peritonæum is a firm, simple, thin, elastic, serous, diaphanous membrane, which lines the Parietes of the Abdomen, to which it is connected by cellular substance; and, internally, it is remarkably smooth, and kept moist by the aqueous fluid which is constantly discharged from the small exhalant arteries which open upon its surface.

It gives a partial covering to the Diaphragm, and to most of the bowels contained within the Abdomen and Pelvis, excepting the Kidnies; and forms ligaments for retaining the bowels in their proper places; and hence the impropriety of the term, Cavity of the Abdomen; as the bowels are, strictly speaking, upon the outer fide of the Peritonæum.

The Aorta, Vena Cava, and Thoracic Duct, are placed behind the Peritonæum.

There are various productions of the Peritonæum; the most remarkable of which are the Mesentery, Mesocolon and Omenta.

The Peritonæum serves to support, to defend, and to fix in their proper situation the bowels of the Abdomen and Pelvis; to conduct the blood-vessels and nerves of the Viscera of the Abdo-

men, and to strengthen the Parietes of the Abdomen; and the liquor effused on its surface prevents the bad effects of friction.

The Blood-veſſels of the Peritonæum are of small size, and are derived from various sources; from the Epigastric, Phrenic, and Lumbar Arteries.

The Nerves of this membrane are derived from the Lumbar, Intercostal, and Phrenic Nerves.

Between the muscles of the Abdomen and Peritonæum, there are, in the adult, four white lines, formed by the Urachus, and the shrivelled Umbilical Artery and Umbilical Veins.

Sect. IV.

OF THE STOMACH.

This term has been applied to the most capacious part of the Alimentary Canal, which is somewhat like a cone twisted upon itself, and with the Base of the cone on the left side, and the Apex on the right side, looking backwards.

The Stomach is connected with the Gullet and Duodenum, and by the reflected Peritonæum and Bloodvessels with the Liver, Omentum, Spleen, Pancreas, and Arch of the Colon.

This portion of the Alimentary Canal is placed immediately below the Diaphragm, and laid obliquely across the body, between the Liver and Spleen; and it occupies the larger share of the

Epigastric Region, and a part of the Hypochondriac Region.

That the position of the Stomach may be better understood, it is necessary to describe it in its undistended, and also in its distended state.

The Stomach, when undistended, presents an *anterior* and *posterior surface*; a *large* and *small curvature*; and two orifices, *the Cardiac* and *Pyloric*.

The Villous coats of the opposite sides of the Stomach are contiguous to each other when the Stomach is empty. When the aliment is accumulated within the Stomach, in consequence of the contraction of the Pylorus, the Stomach yields to the mechanical distension; and its coats, which seem to be at first passive, then seem to adapt themselves to its contents.

As the food is accumulated, the greater curvature of the stomach rises forwards and upwards, and occupies the space between the Cartilages of the Ribs, forming at the same time a considerable angle with the Gullet.

The Pylorus is, as the name expresses, a vigilant sentinel, possessing great sensibility; for the contents of the stomach are not discharged in the order they have entered the stomach, but in proportion as they have undergone the necessary changes within the stomach.

When the aliment within the stomach has been converted into a homogeneous greyish fluid, called *Chyme*, the Pylorus yields, and the contents of the stomach pass into the smaller Intestines.

When the Stomach has been distended, we may observe, especially in examining the bodies of persons who have died a violent death, that the usual comparison of the Stomach *to the pouch of a bagpipe, is not accurate*; for it is somewhat *contracted* towards the Pylorus: in some cases, this contraction is very great, and continues for some days after death, though the Stomach be immersed in water.

This contraction of the Stomach has been noticed by many anatomists. Mr WILLIAM COWPER * has described, in his explanation of his thirty-fourth plate, what he has named '*two bunchings in the lower part of the Stomach*;' and SNEIDER and BLASIUS have mentioned cases in which *the Stomach has been divided into three sacs.*

RIOLAN, † BLASIUS, ‡ MORGAGNI, § LORRY, ‖ WALTER, ¶ LUDWIG, ** HUFELAND, †† and VAN DER KOLK, ‡‡ have also described the contraction in the middle of the Stomach.

* *Vid.* His Anatomy of the Humane Body. London, 1698.

† *Vid.* His Anthrop. p. 17. Published 1662.

‡ *Vid.* LIEUTAUD, Hist. Anat. Med. Vol. I. p. 12.

§ *Vid.* Lit. XVI. Art. 38.; XXVI. Art. 31.; XXX. Art. 7.; XXXVI. Art. 3.; XXXVIII. Art. 28.

‖ *Vid.* Hist. de la Societ. Roy. de Med. Tom. XI. p. 195.

¶ *Vid.* His Catalog. No. 1572 and 1573.

** *Vid.* Primæ Lineæ Pathol. Lips. 1785. p. 40.

†† *Vid.* Journal der Pract. Arzneyk. V. B. P. 823.

‡‡ *Vid.* Dissert. Groning. 1793.

This contraction in the middle of the Stomach is either temporary or permanent, and, according to Morgagni, is connected with a derangement in the functions of digestion.

But a contraction in the middle of the stomach is not always to be found; and Mr E. Home is perfectly correct in stating, " that a contraction in a greater or lesser degree is *very generally* met with."

This contraction of the middle of the Stomach is most obvious in those instances where the Stomach is of unusual size, and where the distance between the opposite extremities is greater than common.

Mr E. Home has described a case, in which he has observed, that " the contraction was so permanent, that, after the Stomach had been kept in water for several days in an inverted state, and at different times distended with air, the appearance was not altogether destroyed." *

In a subsequent paragraph, he has added, " If the body is examined so late as twenty-four hours after death, this appearance (viz. the contraction in the middle of the Stomach) is rarely met with."

But there is a species of contraction of the middle of the Stomach, which does not go off, of which I have a specimen before me † while writing these lines, and where the contraction is at

* *Vid.* London Phil. Trans. for 1807, Part. II.

† Which was sent to me by Mr A. Burns of Glasgow.

present quite obvious, though the Stomach has been preserved for eighteen months in spirits. From the manner in which Mr HOME has expressed himself respecting the formation of the Human Stomach, and its division into two parts by a stricture, it is impossible to decide, whether he means to affirm, that the formation of the Stomach which he has described be the natural one, or only accidental; and if accidental, whether *generally* or only *occasionally*, to be met with; as in the same paper, published in the Lond. Phil. Trans. Part 2. for 1807, he has asserted each of these positions *. I must beg leave, notwithstanding the great respect I entertain for Mr HOME's talents and skill as an anatomist, to differ from him as to the first position he has laid down, that the Human Stomach is divided into a Cardiac and a Pyloric portion; and in this I am supported, not only

* "The Human Stomach *is divided into a Cardiac and Pyloric portion, by a muscular contraction,* similar to those of other animals; and as this circumstance has not before been taken notice of, it may be necessary to be more particular in describing it." P. 170.

"Since that time I have taken every opportunity of examining the Human Stomach after death, and find that this contraction, to a greater or less degree, is very *generally met with.*" P. 171.

"It (the Human Stomach) *is occasionally divided by a muscular contraction into two portions;* these are in shape, and relative size, sometimes similar to those of the Beaver; at others to those of the Horse." P. 157.

by my own observations, but also by the concurring testimony of the most eminent anatomists of all ages.

There is also a mistake in the assertion which forms the concluding part of the same sentence, That this stricture was unnoticed by any former anatomist. In proof of this I have only to refer the reader to the references at the bottom of p. 111.

The second position laid down by Mr Home, That the stricture of the Stomach is not universally, but "very generally" to be met with, is also objectionable. His last position is, that this stricture is only "occasionally" to be met with; to which I readily subscribe: but what is occasional cannot be said to be constant.

That this stricture, *or occasional appearance of the Stomach*, described by various anatomists, and which has occurred to myself, is generally the result of Spasm affecting particular muscular fibres of the Stomach, and which takes place during life, and appears even after death, and is a morbid not a natural appearance, seems to me proved by the following circumstances:

1st, As there is no peculiar organization of the Stomach, or band of muscular fibres, to cause such a division; and as the stricture, according to Mr Home, varies in situation, degree of contraction, and extent, in different subjects, which could not be the case were it a natural formation of the Stomach itself.

2d, As we observe still more frequently a similar appearance, and to a greater extent, the consequence of a spasmodic contraction in the turns of the intestines, both great and small, in the gall-bladder and bladder of urine ; when upon examination there is no organic disease, and which therefore can be occasioned by spasm alone.

3d, Mr HOME has supplied a further argument against his own supposition, by assuring us that this stricture of the stomach can only be observed when the body is opened soon after death, and that it entirely disappears in twenty-four hours; whereas, were it a natural contraction, it should remain until the stomach be destroyed by putrefaction.

There is no organ which receives a larger supply of blood than the Stomach.

The Arteries of the Stomach are branches of the Cœliac Artery ; and the Veins which correspond with these arteries, assist in forming the Vena Portarum.

The Nerves of the Stomach are derived from the Eighth Pair and the Sympathetic Nerves.

Of the Coats of the Stomach.

There are only Three Coats proper to the Stomach ; the Peritoneal, the Muscular, and the Villous : for I reject entirely what has been called the Nervous Coat, which is merely the cellular substance connecting the different Coats, and

which, being more loose between the Muscula and Villous Coats, has been described by Anatomists as the Third Coat of the Stomach.

The Coats of the Stomach are not easily separated from each other.

The Peritonæum, reflected from the Liver, forms the External Coat of the Stomach. The Second Coat is made up of distinct muscular fibres, which may be divided into two strata.

The external stratum is continued from the Gullet; and the greater part of this stratum is disposed in a longitudinal manner, from the left to the right side of the Stomach. On each side of the small curvature of the Stomach, this stratum forms a distinct fleshy band of muscular fibres.

The interior stratum of muscular fibres is disposed in a circular manner.

The Third Coat is much more extensive than the First and Second; and forms the Plicæ of the Stomach, the greater number of which are disposed in a transverse direction.

At the lower orifice of the Stomach, there is a distinct circular muscle, which has been called *Pylorus*, which is covered by the cellular and villous coats of the Stomach, and varies as to form and size *.

* Soemmering, (de Corporis Humani fabrica, tom. vi. p. 222.,) speaking of the Pylorus, has observed: ' Forma, ' magnitudo, crassities atque ostium hujus Pylori ad sequentes ' tres varietates præcipuas redigi possunt: Interdum integer qui-

Sect. V.

OF THE GASTRIC JUICE.

Besides the Mucus, a fluid, peculiar to the stomach, and therefore called *Gastric*, is also found within the Stomach. Respecting the secretion and nature of this fluid, different opinions have been entertained. According to some authors, it is secreted by the small arteries, distributed upon the villous coat of the Stomach; according to others, this fluid is prepared by numerous small glands situated in the vicinity of the Cardia.

This last opinion is rendered probable by anatomists having observed in the stomach of the Ostrich, glands of a large size, imbedded between the muscular and villous coats; the ducts of which are large enough to be visible, and are found to open upon the internal surface of the Stomach.

We are still imperfectly informed as to the *chemical qualities* of the Gastric Juice, owing to the difficulty of obtaining it pure, and in sufficient quantity to be submitted to a chemical analysis, and also from its qualities being constantly altered by the admixture of the food. The Gastric Juice obtained by exciting vomiting upon an

'dem annulus est, sed tenuis, ex orbibus concentricis formatus, 'amplus spatioso admodum ostio. Interdum pars annuli aliqua 'reliquo ambitu latior est, et ostium modicè amplum ovatum. 'Interdum annulus parvus, oblongus, ovatus, ostio oblongè 'ovato, et valdè angusto hians.'

empty stomach, or by thrusting a piece of dried sponge into the stomach to collect it, or by collecting it from the stomach of an animal recently killed, is still *an impure fluid*, being mixed with Mucus and Saliva, and sometimes with Bile.

Dr STEVENS's experiments with perforated balls have pointed out, that there is a considerable distinction between the Gastric Juice of a carnivorous and graminivorous animal.

He gave to oxen and sheep, balls filled with animal substances, which *were not dissolved;* but when the balls were filled with grass, *it was consumed.*

From the experiments which MAUQUART and VAUQUELIN made on the Gastric Juice of sheep, it appears that sometimes the uncombined phosphoric acid is present; but on other occasions, no acid; and from the experiments of SPALLANZANI, it seems to partake neither of an acid nor of an alkaline nature.

The Gastric Juice, particularly in young animals, has the property of coagulating milk. The coagulated milk thrown up by infants immediately after sucking, and the well-known use of the stomach of the calf in our dairies, sufficiently prove this fact.

Dr YOUNG found that the Stomach retained this power after being repeatedly washed, and that the infusion of a portion of the Stomach employed as runnet, did not lose its coagulating power though mixed with an alkali.

Brugnatelli informs us, that the Gastric Juice of carnivorous animals, as Hawks, has a bitter taste and pungent smell, and not at all watery; and contains an uncombined acid, with a small quantity of the muriate of soda.

On the other hand, Carminati informs us, that the Gastric Juice of sheep is watery, has a bitter taste, and contains ammonia, an animal extract, and a large proportion of the muriate of soda.

From the above, there is reason to conclude, that the Gastric Juice is adapted to the food of the animal, *and therefore different in the different classes of animals.* There is likewise reason to suppose, that it is somewhat different at different times, and in different individuals.

Most of the graminivorous quadrupeds, when young, are fed chiefly on milk, and some birds chiefly on animal substances.

A chick for the first few days is nourished by the yolk of the egg; and the pigeon feeds its young at a very early period with a curd formed in its crop, mixed with its grain, till they arrive at a certain age, when they are fed on grain alone; proving, more clearly than Spallanzani and Mr Hunter's Experiments on the Eagle, that the food of an animal, intended to live ultimately on vegetables, may, in the earlier period of its existence, be purely animal, or at least of a mixed nature.

The operation of the Gastric Juice in cold-blooded animals is not so powerful as in other classes; and it has been observed likewise to act

still more slowly during the winter when they are in a torpid state, and to have its activity again increased by exposing them to a greater degree of heat *.

The most remarkable circumstance in the history of the Gastric Juice is, *that its power is purely chemical; for it operates as powerfully upon the animal fibre out of the body, as within the Stomach of a living animal;* and actually is observed to dissolve the Stomach itself after death.

From this fact, it is obvious, that its operation is confined to the dead animal fibre, and that it

* My Father, during a severe winter, (1764,) kept a Hedgehog in a room where there was no fire from the month of November till March. He placed near the animal boiled beef, bread, cheese, potatoes, water, and straw. About the beginning of December, the Hedgehog was affected with an unusual degree of drowsiness. He, however, continued to eat, though more sparingly, till the 25th of that month. From that time till the 8th day of March following, he continued in a profound sleep, except when artificially roused. After being thus roused, he soon walked back to his place of retreat, and resumed his dormant state. On the 25th of December, he weighed thirteen ounces and three drachms; on the 6th of February eleven ounces and seven drachms; and, on the 8th of March, eleven ounces and three drachms. There was a small quantity of feculent matter and urine among the hay. At the time of his actual reviviscence, no person was present; and, of course, the circumstances attending it are unknown. In the course of three months, the Hedgehog had neither ate nor drank; but remained constantly in a profound sleep among the straw. Its limbs, however, were never rigid; but it lost two ounces of its weight. *Frogs*, which my father kept during the winter in a vessel with water, seemed to be in a similar state with that of the Hedgehog.

has no effect upon the living. This inference may appear to some contradicted, by an experiment of Dr Stevens's, who inclosed a living leech within a silver hollow ball, which the stone-eater swallowed. Upon examining the leech within the hollow sphere, after it had passed through the alimentary canal of the stone-eater, it was found to be nearly dissolved ; for nothing remained except a viscid black mass.

This experiment, though ingenious, is not perfectly conclusive of the fact in question, as the leech was probably killed within the Stomach, and afterwards acted upon by the Gastric juice, like dead animal substances.

The Gastric juice possesses another very remarkable property ; it is antiseptic, and arrests the process of putrefaction in substances in which it had begun.

The food within the stomach is exposed to the ninety-seventh degree of heat of Fahrenheit ; is intimately blended with the juices of that organ, and exposed to the muscular action of that organ ; by which it loses its tenacity, becomes of an ash colour, then gelatinous, and is converted into a grey-coloured fluid called *Chyme*. Of these changes, we may have ocular demonstration, sometimes during life, or by killing animals at different times, after feeding them.

Richerand has related a very interesting case, in which there was a considerable opening in the Stomach, in consequence of an injury. The pa-

tient, when received into the *Charité*, ate three times as much as ordinary; and had a stool once in three days.

But three or four hours after a meal, she felt an irresistible desire to remove the dressing from the Stomach, to allow the food to escape, *which was converted into a greyish paste, and had a faint odour, but was neither acid nor alkaline.*

The contents of this patient's Stomach was accurately examined, and it was found that there was an increase of jelly; a substance like fibrine was formed, and also a considerable proportion of muriate and phosphate of soda, and of phosphate of lime.

In the morning, the Stomach contained a quantity of thick frothy liquid, resembling saliva, in which there were several albuminous flocculi.

By chemical analysis, the above fluid was found to be similar to saliva.

The patient dragged on a miserable existence; was greatly emaciated, being imperfectly supported by the small quantity of food which passed through the Pylorus, and the small quantity which was taken up by the absorbents of the Stomach.

Sect. VI.

OF THE THEORIES CONCERNING THE AGENT BY WHICH THE FOOD IS CONVERTED WITHIN THE STOMACH INTO CHYME.

The remarkable changes which the aliment undergoes within the Stomach, have been ascribed

by diffeerent authors to different causes; to an INCIPIENT PUTREFACTION; by others to FERMENTATION; by some to TRITURATION; and, by a third set, to the GASTRIC JUICE.

The limits of this book permit me only to add, upon this very interesting and extensive subject, that the changes which the aliment undergoes within the Stomach, are, in my opinion, to be ascribed chiefly to the operation of the Gastric Juice upon the food. The above opinion is founded upon the experiments of my Father, who found that Bone was dissolved by the Gastric Juice of Dogs; and also upon Dr STEVENS's experiments, who found, that if tubes containing alimentary substances, were not perforated, no change was produced; but when the tubes were perforated, their contents were converted into chyme.

In short, the Gastric Juice is not a diluent, but a solvent; and the solvent power of the Gastric Juice, is different in different animals. In the herbiverous animals, it dissolves vegetables only; whilst in the carnivorous and fish, its operation seems confined entirely to animal matter; whereas, in man, and animals destined like him to live both on vegetable and animal matters, its solvent power seems equally effectual on either; for it is adapted to the digestion and assimilation of certain vegetables, as well as animal matters *.

* It seems that, as yet, we are much in the dark as to the nature of the Gastric Juice, which probably differs very much, not only in animals of different classes, but in animals of the

Air within the Stomach and Intestines.

In the healthy state of the digestive power, air, though certainly generated, is immediately re-absorbed, and therefore no air is found either to distend the Stomach, or is emitted from it.

Wherever, therefore, air is contained in the Stomach, it affords evidence of an imperfect digestion, and that the animal fermentative process, which takes place in vegetable and animal matter, placed in certain circumstances out of the body, has in these instances taken place within it.

From Mr JURIN of Geneva's experiments made on air emitted from the Stomach, it appears, that it consisted chiefly of azote, with a small proportion of carbonic acid gas, and a still smaller proportion of oxygen. Other experiments seem to shew that it is chiefly carbonic acid.

same class, some eating that kind of food with impunity, which proves a poison to others; a fact which I have already taken notice of in my Thesis, 'Quasdam tamen res quibusdam animalibus lethales, aliis animantibus minimè nocere, notandum est; sic, capri cicuta, vaccis perniciosissima, impunè vescuntur; porci hyoscyamo pinguescunt; equus vitri antimonii quantitatem quæ centum homines necaret, impunè tolerare potest; canis opii copiam homini huic non assueto lethalem, sine periculo devorare potest: Contrà autem, dosis jalapæ aut nucis vomicæ, aut amygdalæ paucæ amaræ, eundem convellerent aut extinguerent.'

Sulphurated and Phosphorated Hydrogen Gases are also found within the Stomach and Intestines of the dyspeptic, gouty, &c.

It also seems probable, that a part of the air is swallowed along with the food, and a part secreted by the blood-vessels.

SECT. VII.

OF THE INTESTINAL CANAL.

THE Intestines, on account of their unequal diameter, have been divided into the Smaller and Greater Intestines.

The Colon, the greatest portion of the larger Intestines, surrounds the smaller.

The smaller Intestines extend from the Stomach to the Valve of the Colon. They are longer than the larger Intestines; and have been divided by anatomists into three parts, *Duodenum*, *Jejunum*, and *Ileum*.

The whole tract of the smaller Intestines is not of equal calibre: that portion next the Stomach is the largest, and that next the Colon is the smallest. Hence the smaller Intestines form a conical, not a cylindrical tube.

The greater share of the smaller Intestines is very moveable, excepting the Duodenum, which is firmly fixed down by the Layers of the Mesocolon.

Of the Duodenum.

The Duodenum is that portion of the smaller Intestine which is joined to the Stomach: it is much more capacious than the Jejunum or Ileum, and hence has been called by RIOLAN, the Assisting Stomach.

This Intestine describes various turns. From the Pylorus it turns backwards, and upwards, and then downwards under the neck of the Gall-Bladder, with which it is in contact; it then passes obliquely downwards, to the right side; and, included within the cellular substance of the Mesocolon, it passes to the left side, across the Lumbar Vertebræ; below the Pancreas, and behind the superior Mesenteric vessels, and root of the Mesentery and Mesocolon, and ends in the bowel called Jejunum.

Of Chylification, or of the Changes which the Food undergoes within the Duodenum.

The food within the Intestines is changed into an excrementitious and useless part; and into a chylous or nutritive fluid; which latter is absorbed by the Lacteal Vessels.

Though the Duodenum at first sight be similar in structure to the other smaller Intestines, yet there is reason to suppose, that the alimentary mass is longer detained in the Duodenum, than in other parts of the smaller Intestine; as it is much more capacious, more curved, and provided with a great number of Valvulæ Conniventes.

The assimilation of the alimentary mass within the Duodenum, is promoted by the addition of the *Bile* and *Pancreatic Juice*, by which acids, taken in along with our food, or generated by a morbid state of the Stomach, are blunted, and probably neutralized.

The effect of the acid matter upon the aliment, is thus counteracted; for, when Bile is mixed with any acid, the acidity takes off the bitterness of the Bile, and the bitterness of the Bile takes off the acidity, and may perhaps bring about the separation of the Chyme, into the Chyle and excrementitious matter.

The Bile is probably separated into two parts within the Duodenum, viz. into the Albuminous part, which flows into the blood along with the Chyle, and into another part, which communicates its colour and bitterness to the excrement, and which serves at the same time to stimulate the Intestinal Canal.

On opening the smaller Intestines, we meet with a mucous and gelatinous fluid, mixed with their contents, and sometimes a white, and at other

times a yellow fluid, besmearing the villous coat, which in a healthy digestion, may be perfectly distinguished from the alimentary mass.

No acid is ever found within the Intestines in a healthy person.

The air on some occasions found, is chiefly azote, with a small quantity of carbonic acid gas, hydrogen, and a sugary matter.

Of the Chyle.

In Man and Quadrupeds, the chyle is of a white colour, like milk; and contains albumen, serum, and globules, with salts of different kinds; and, according to some, a substance like the sugar of milk.

From the difficulty of collecting this fluid in purity, and in sufficient quantity, from the Lacteal Vessels, its chemical qualities have not been as yet fully ascertained.

Of the Jejunum and Ileum.

These portions of the smaller Intestines describe a great many turns.

The convolutions of these Intestines, fill up the greater share of the cavity of the Umbilical and Hypogastric Regions, and also a share of the cavity of the Pelvis.

As these Intestines are perfectly moveable; they

are displaced by the gravid uterus, and by the stomach when much distended.

These portions of the smaller Intestines are very similar to each other; the Ileum is somewhat smaller, and not of so red a colour as the Jejunum.

These portions of the small Intestines have an oblique direction from the left side to the Caput Cæcum Coli, which lies on the right Os Ilium.

Of the Valvula Coli.

The Ileum opens into the left and posterior side of the Caput Cæcum Coli, forming an acute angle with the Cæcum, and a right angle with the Colon. Between the larger and smaller Intestines, there is a valve, composed of two folds of the internal coat placed transversely; and each fold composed of small internal Laminæ.

The superior fold is laid transversely, and generally is shorter than the other.

But the length and breadth of the folds are various; as also the size of the interposed aperture.

Sometimes the lower fold is long and broad; and the upper one short and narrow.

Sometimes both folds are slightly prominent, and their distinction is not obvious.

The Peritoneal Coat, extending from the Ileum to the Caput Cæcum Coli, retains these Intestines in their relative positions.

Upon cutting the Peritonæum and Muscular Coats at the union of the two Intestines, the internal villous Coat may be so elongated that the valve completely disappears.

The turns of the smaller Intestines are retained in their proper place by means of a membrane, which, on account of its situation, has been called Mesentery.

This is a flat and broad membrane, composed of two layers of Peritonæum; between which the Arteries, Veins, Nerves, and Lacteal Glands and Lacteal Vessels are placed.

The Intestines are placed and nearly inclosed at the extremity of this duplicature, and being longer than the Mesentery itself, have the appearance of being gathered or puckered: From this beautiful mechanical contrivance, their convolutions cannot be entangled or involved with each other, nor shaken from their place by the various or sudden movements of the body, and are also evidently less liable to be injured by external violence.

Larger Intestines.

The larger Intestines extend from the Caput Cæcum Coli to the Anus, and are distinguished from the smaller by their size, form, situation, Appendices Epiploicæ, connexions, and functions.

The situation of the larger Intestines is more constant and defined than that of the smaller Intestines.

Course of the Larger Intestines.

From the Caput Cæcum Coli the Colon ascends, and lies before the Right Kidney; it then goes upwards and backwards under the Liver, then passes across the body from right to left, under the Gall-Bladder, Stomach, and Spleen; with which last it is connected by the Omentum Majus.

It descends on the left side of the Abdomen, to form what has been called, from its resemblance to the Sigma of the Greeks, its Sigmoid Flexure. It afterwards descends into the Pelvis to form the bowel, commonly called Rectum, the other extremity of which forms the Anus. The larger Intestines have been divided by Anatomists into the Caput

Cæcum Coli; the ascending part of the Colon on the right side of the Colon; the transverse arch; the left descending portion; the Sigmoid Flexure; and that part attached to the Os Sacrum, which has been named Rectum, although it should rather have been named *Curvum*, as it describes a portion of the same curve as the Os Sacrum.

The Colon is not of an equal size. The Caput Cæcum Coli, which is situated on the right Os Ilium, is much more capacious than any other part of it: it is about four or five inches in diameter, and sometimes even more. It is properly the Caput Cæcum, from the left side of which there is an appendage of a tortuous shape, about five inches long, and having the same coats as the intestines: it is about the diameter of a middle-sized writing pen, having a blind end; and has been named *Appendix Vermiformis*.

The fatty Papillæ, called Appendices Pinguedinosæ, attached externally to the large Intestines, the Adipose Strata, the Pouches of the Colon, produced by three ligamento-muscular bands, beginning at the Appendix Vermiformis, and which are shorter than the Intestine itself, and accompany it through the whole of its course, until they unite and form two bands at the Rectum, are peculiar to the larger Intestines.

The large Intestines are retained in their situation by a membrane similar to the Mesentery, called Mesocolon, which may be divided into three parts.

The Mesocolon Dextrum passes from the Liver and from the right Quadratus Lumborum, covering only the anterior part of the Colon, and fixes it firmly down to the Iliac muscle.

The second portion may be called the Transverse.

That on the left side, or third portion, called Mesocolon Sinistrum, is continued over the left side of the Colon, from the Iliac vessels and Psoas Magnus, to the left Kidney, covering only the anterior surface of the Colon, the back of which is connected by cellular substance with the Diaphragm, the Psoas muscle and the Kidney.

Of the Contents of the Larger Intestines.

The excrementitions part of the alimentary mass, is found within the large Intestines; which, being very capacious, serve as a reservoir, within which the fæces are collected, in order to prevent the necessity of their constant evacuation.

There are fewer Lacteal vessels proper to the large than to the small Intestines: notwithstanding of which, nutritious clysters have been found capable of supporting life for a considerable time. On account of the great size of the Colon in some animals, it seems probable that the alimentary mass undergoes some great and important change within it, especially in the horse; in which ani-

mal the Colon is much more capacious than the Stomach.

Chemical Analysis of Human Fæces.

HOMBERG, and some of the older Chemists, made experiments on the Fæces; and, more lately, BERZELIUS * has taken up the same subject; and the following is the result of his analysis of Fæces.

Water	73·3
Vegetable and animal remains	7.0
Bile . . . , ...	0.9
Albumen	0.9
Peculiar extractive matter	2.7
Slimy matter, containing resin of the bile, peculiar animal matter, and insoluble residue	14.0
	† 100.0

SECT. VIII.

OF THE COATS OF THE INTESTINES.

THERE are Three Coats proper to the Intestines; a Peritoneal Coat, a Muscular Coat consisting of

* The consistency of human fæces varies considerably; but, at a medium, they may be stated to lose three-fourths of their weight when dried upon a water bath. *Vid.* GEHLEN'S Journ. VI. p. 535.

† *Vid.* GEHLEN'S Journ. VI. p. 536.

two strata of fibres, and an internal Villous Coat. What has been usually called the Nervous Coat, is merely the Cellular substance which connects the Muscular and Villous Coats.

First Coat.

The Peritoneal Coat is very thin, and nearly transparent; so that the Muscular Coat is seen through it.

Its external surface is quite smooth, and lubricated, like other serous membranes, by a thin serous fluid. This Coat possesses considerable toughness and elasticity.

Of the Second Coat.

The second Coat is composed of Longitudinal and Circular Muscular Fibres.

The former are very thin and pale, and visible only on the convex surface of the Intestine; whereeas the latter, the Circular Fibres, are much coarser, and more apparent, especially in the Duodenum; but they are not so obvious in the Jejunum and Ileum. Upon examining minutely each Circular Fibre, it may be observed to be made up of several segments of circles.

The contents of the Alimentary Canal are propelled by the joint action of the Muscular Coat and of the Abdominal Muscles. Hence, when a portion of the Intestine has been displaced, as in Chronic Hernia, a degree of constipation follows, the contents of the Intestines being, in such circumstances, propelled onwards solely by the muscular contraction of the Coats of the displaced Intestine; for the Abdominal Muscles are of no service in promoting the evacuation of their contents.

The Intestines of every animal are in constant motion, or perform what is called a *peristaltic* and *antiperistaltic* motion.

The peristaltic motion has commonly been said to be continued regularly from the top to the bottom of the Canal, by which the food is propelled downwards, whereas this action begins at once in several parts of the Canal; and whenever the food is applied to any part of the Intestines, it contracts itself, and makes a firm point, to which the portions above and below are drawn by means of the longitudinal fibres, which shorten the Canal, and at the same time dilate the under part.

The antiperistaltic action is exactly the reverse of the above, and by it the food is turned over and over and exposed to the orifices of the lacteal vessels; and in cases where the free progress of the aliment is interrupted, this inverted action

is sometimes so great, that the contents of the intestines and glysters thrown up have been rejected by vomiting.

The rapidity with which the peristaltic and antiperistaltic motions take place varies considerably, depending on the degree of excitement, and sensibility of the Intestine.

Of the Villous Coat.

The Villous Coat is connected by a loose band of Cellular substance, called, improperly, Nervous Coat, to the Muscular Coat.

It is much more extensive than the other Coats, and forms doublings, called *Valvulæ Conniventes ;* improperly ; for they do not perform, with accuracy, the office of Valves.

These doublings are placed transversely in the Jejunum. In the Duodenum and Ileum they are disposed longitudinally ; and in the Ileum, they become gradually very small, and almost disappear in the end of it.

These *Valvulæ Conniventes* very rarely extend through the whole circle of the Intestine ; often they are joined by communicating folds.

These Valves are broadest in the middle, and narrower at the extremities. In general, they are

about a line and a half broad. One edge of these Valves is loose; but the other is fixed to the Intestine.

The Villous Coat is covered with *Villi;* and, after filling the bloodvessels, these Villi seem to be made up of a *network of Bloodvessels, Nerves, and Orifices of the Mucous Ducts and Lacteal Vessels.*

Of the Coats of the Larger Intestines.

The Coats of the Larger Intestines in some measure resemble those of the smaller. The longitudinal muscular fibres are collected into *three bands,* which have the appearance of Ligaments placed at equal distances on the surface of the Intestine; and these shorten the intestine in such a manner, as to give the surface of the intestine a cellular appearance; or, the intestine seems made up of a triple row of hemispherical protuberances.

These bands originate from the Appendix Vermiformis, and become gradually broader, until they terminate in the Muscular Coat of the Intestinum Curvum.

In consequence also of the Longitudinal Ligament contracting the Intestine, the Peritoneal and

Muscular Coats form large transverse folds, which are larger at the beginning of the Intestine, become gradually smaller, and are at length lost in the Curvum; and between these folds large Cells are formed.

Mucous Glands of the Intestines.

The Mucous Glands of the Intestines are more or less obvious, being of different sizes. They are numerous in the smaller Intestines, and are *collected into groups*, or *solitary*.

Appendix Vermiformis.

The Appendix Vermiformis is fixed down to the posterior part of the Caput Cæcum Coli by the Peritonæum, which forms its Mesentery.

This Appendix, into which the fæces do not pass, is cylindrical in shape, tortuous in its course, about four or five inches long, and ends in a blind Sac.

There are many mucous glands between its Coats, which secrete a mucous fluid, which probably passes into the Cæcum.

Intestinum Curvum, commonly called Intestinum Rectum.

The bowel commonly called Rectum, is fixed by the doubled Peritonæum, or *Mesorectum* to the Os Sacrum, which is concave towards the Pelvis; and hence I have ventured to call it Curvum, instead of Rectum. The Peritonæum covers the sides and anterior part of this bowel, and is then reflected upon the posterior and inferior part of the Bladder of the male, and in women upon the upper part of the posterior surface of the Vagina.

Beyond this reflection of the Peritonæum, the Rectum continues its course downwards for two inches, and is united to the vesiculæ seminales by cellular substance and prostate gland, and in the female to the vagina.

The Muscular Fibres of it are thick and strong, and extend uniformly over the surface of the intestine.

The extremity of this bowel, which is amply supplied with Mucous Glands, is somewhat contracted, serving in a degree to assist the Sphincter in retaining the fæces.

The Anus is surrounded by Fat and Cellular substance, by which the Rectum may be considerably dilated, and the Mucus Follicles around the verge of the Anus prevent it from being irritated.

The extremity of the Intestinum Curvum is much less irritable than the other parts of the Intestinal Canal, and is enlarged somewhat above the Sphincter Ani. This is very conducive to our convenience. By these means, the fæces are retained and accumulated for a time within the Rectum; by which we are enabled to chuse a fit time and place for discharging the contents. But in cases where there is a great accumulation of fæces, if the individual does not obey the warning, the muscles act involuntarily, and expel the fæces.

The Muscular Fibres of the Intestinum Curvum are thicker and stronger than those of any other part of the intestines.

There are a number of Mucous Follicles at the verge of the Anus, which secrete a good deal of Mucus, in order to prevent excoriation.

The Anus is also enveloped in a quantity of Fat, which admits of the expansion of the Intestinum Curvum.

Arteries and Veins of the Intestinal Canal.

The Intestinal Canal is largely supplied with blood.

The Duodenum receives blood from the Hepatic and Splenic Arteries; and the other parts of the Intestinal Canal are supplied by the Superior and Inferior Mesenteric Arteries.

The Veins of the Intestines assist in forming the Vena Portarum.

Nerves of the Intestines.

The Intestines are supplied with Nerves from the Great Sympathetic and Eighth Pair of Nerves; and these Nerves are frequently united, and form what Anatomists have named *Ganglia*; from which a great many small Nerves issue out in all directions, to supply every part of the Intestinal Canal.

SECT. IX.

OF THE MUSCLES OF THE ANUS.

The extremity of the Curvum or Rectum is provided with muscles, which assist in the expulsion of its contents, and in its retraction after the fæces have been expelled.

These muscles are the COCCYGI-CUTANEO-SPHINCTER, or the *Sphincter Ani*; the SUB-PUBIO-COCCYGEUS, or *Levator Ani*; the ISCHIO-PERINEALIS, or *Transversalis Perinæi*, Muscles.

COCCYGI-CUTANEO-SPHINCTER, or *The Sphincter Ani.*

This muscle surrounds the extremity of the Anus.

Some Authors have described this muscle as consisting of two parts, the *Sphincter externus* and *internus;* but the latter is rather a part of the muscular fibres of the Intestinum Curvum.

The proper Sphincter Ani is imbedded within the skin, fat and cellular substance: It consists of two distinct strata, the fibres of which describe concentric arcs, which decussate each other, and are united in a point, both before and behind, as has been very accurately described and represented by Dr CAMPER, in his Demonstrationes Anatom. Patholog.

Behind, this muscle is connected with the extremity of the Os Coccygis by a ligamentous substance; and before, it is connected to the Accelerator Urinæ, the Transversalis Perinæi, and Levator Ani.

By this muscle, the extremity of the Intestinum Curvum is shut, by which the fæces are retained; yet when it is requisite, and in obedience to the will, it yields, so that this may be named a *Semivoluntary Muscle.*

SUB-PUBIO-COCCYGEUS, or *Levator Ani.*

This muscle takes its origin by short tendinous fibres from the inner side of the arch of the pubes; from the tendinous aponeurosis of the Obtura-

tor Internus muscle: from the Spine of the Ischium; and also from the Os Coccygis, from which the muscular fibres diverge as from a centre.

The fibres of this muscle follow different directions, and are inserted, and intimately incorporated with the muscular fibres of the side of the Rectum, and also with the fibres of the Sphincter Ani muscle, and Accelerator Urinæ.

This muscle forms the lowest part of the cavity of the abdomen.

It also retracts the Intestinum Curvum, after the evacuation of the fæces; and, by pressing upon the Vesiculæ Seminales, and Prostate Gland, may assist in expelling the contents of these parts.

The part of the muscle which arises from the Ossa Pubis, and incloses the Prostate Gland, has been named by ALBINUS the *Compressor Prostatæ.*

ISCHIO-PERINEALIS, or *Transversalis Perinæi.*

This muscle arises from the inner side of the tuberosity of the Ischium, behind the Erector Penis, is disposed in a transverse direction, and is inserted into the back-part of the Accelerator Urinæ. This muscle serves to dilate the bulb of the Urethra, and also assists in retracting the Intestinum Curvum, after the fæces have been evacuated.

There is sometimes another slip, which has been described as the *Transversalis Perinei Alter*.

ISCHIO-COCCYGEUS, or *Coccygeus*.

This muscle takes its rise from the Spinous process of the Ischium, and is fixed into the side of the Os Coccygis, which it pulls forwards; and it also assists in raising the Curvum.

There is a part of the same muscle which arises from the under and fore part of the Os Sacrum, which is fixed into the fore part of the Os Coccygis, and which has been called the SACRO-COCCYGEUS, or Curvator Coccygis, as it assists in bending the Os Coccygis.

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PART IV.

CHAPTER I.

OF THE ORGANIC DERANGEMENTS OF THE ALIMENTARY CANAL.

It is proposed to divide the Organic Derangements of the Alimentary Canal into two great Classes.

The First Class *contains a very brief description of those Organic Derangements which are peculiar to the Organs of Manducation and Deglutition:* And the Second, *of those which are peculiar to the Stomach and Intestines.*

Before proceeding farther, it may not be improper to observe, that as the same kind of structure pervades the Alimentary Canal, there must exist a great resemblance between the Organic Derangements to which its component parts are subject.

The above division is therefore artificial, and calculated merely to point out those Organic De-

rangements to which the Organs of Manducation and Deglutition, from their peculiar office and situation, are exclusively exposed.

Of the Organic Derangements of the Organs of Manducation and Deglutition.

From the preceding very brief account of the functions of the organs concerned in Manducation and Deglutition, it follows, that for the performance of these functions, the cooperation and perfect action of many parts is necessary: hence the various causes which impair or wholly impede deglutition. *

Mastication is performed by the action of the Jaws and Teeth: hence, when the under Jaw is fractured or dislocated, it cannot perform the necessary movements.

The Teeth, from their situation and office, are much exposed to external violence and disease. They are often inflamed, but do not swell.

Spots of different colours are seen on the enamel of the Teeth.

The enamel is sometimes discoloured, from chewing tobacco; and it has been stated, that the bony parts of Teeth acquire a yellow hue from the Jaundice.

* For a more full exposition of the various causes of Dysphagia, see my Thesis on that subject.

The Teeth very often become carious; and this generally begins between the Teeth, and extends inwards, to the very centre of the body of the Teeth, exposing the sensible pulp of the Tooth. The Tooth is excavated; the enamel remaining like a shell.

But the Teeth are not affected by the constitutional diseases of other bones, Lues Venerea, Rickets, and Mollities Ossium.

Of Malconformations and Diseases of the Lips and Cheeks.

There are several Organic diseases which prevent the Lips, Cheeks, and Tongue, from performing their usual action,—the retaining the food between the Teeth during manducation. The inner membrane of the Lips is sometimes so much relaxed, as to protrude between the Lips. Children are sometimes born with the Lips adhering to each other; or with a Fissure in the Lip, or with two Fissures; and a considerable space sometimes intervenes between the Fissures. The Fissure is moſt frequent in the Upper Lip; and in some such cases, the Bony Palate is split, and also the Uvula. The Lips and Cheeks are often inflamed, covered by Apthæ, eroded or ulcerated, from an unnatural projection of the Fore Teeth, Scurvy, or Lues Venerea.

Cancer sometimes appears in the Lips, and most frequently in the Under Lip. The disease appears in the form of a dark brown-coloured Wart, or in the form of a deep spreading Ulcer, or like a hard Tumour, which ulcerates in its centre; and the neighbouring Lymphatic Glands, especially that under the Chin, partake of the same disease.

Malconformation and Diseases of the Tongue.

The Tongue has been described as awanting; sometimes double; and sometimes of a monstrous bulk. It sometimes adheres to the Cheek, in consequence of previous inflammation.

The cuticle of the Tongue becomes much thicker than natural in some fevers, and after a time comes off in thick flakes.

The other organic diseases of the Tongue are, Inflammation; Swelling, and Ulceration; which are very often the effect of carious Teeth, or of Lues, or its antidote. The Tongue is sometimes covered by Apthæ.

The Tongue often appears hard; there is a crack or fissure in it; it then bleeds; and at last degenerates into a Cancer. The Ulcer bleeds frequently; and the patient dies, exhausted by the repeated hæmorrhagy.

Scirrhous Tumours sometimes grow in the Tongue, which degenerate into Cancer, and extend to the Lips in some cases.

Small Watery Vesicles, about the size of a pea, or Hydatids as they have been called, sometimes appear in the Tongue.

Sometimes, though very rarely, the Frænum Linguæ is too short; and the child cannot suck.

Diseases of the Os Hyoides.

The Cornu of the Os Hyoides has been dislocated.

Exostoses sometimes grow from the Os Hyoides, and impede deglutition.

Organic Diseases of the Palate.

The Palate is made up of the Hard and Soft Palate.

The Bones of the Palate have been frequently eroded, from Lues Venerea, and other diseases.

The soft Palate is sometimes fissured; and when that happens, the food, instead of passing into the Pharynx, passes into the Nose.

The Soft Palate is much inflamed in the Cynanche Tonsillaris, and also ulcerated; and it is frequently eroded by Lues.

Polypi also sometimes grow from it, and hang into the Pharynx.

Sometimes the Soft Palate adheres to the Pharynx, from long continued ulceration.

The Uvula is often swelled and relaxed, so that

it becomes longer than usual, and irritates the Fauces very much; or Tumours grow from it.

Organic Derangements of the Salivary Glands.

During the manducation of the food, it is mixed by a large quantity of Saliva and Mucus.

Diseases of the Salivary Glands are by no means unfrequent, especially those of the Parotid Glands, and are observed in many malignant fevers.

The Parotid Gland is frequently inflamed.

In cases of Mumps, there is often a considerable swelling of this Gland.

The Sublingual Gland is often inflamed, occasioning a painful Tumour under the Tongue.

Purulent matter is sometimes collected in the Cellular substance, between the Lobes of the Parotid Gland, or in the Cellular Substance which lyes over that gland.

Wounds and Diseases of the Ducts of the Salivary Glands.

The Ducts of the Salivary Glands having been divided by a cut with a sword, or destroyed by ulceration, the Saliva is then constantly discharged, occasioning a Salivary Fistula; or these Ducts have been much extended, in consequence of obstruction by *Salivary Concretions.*

The enlargement from the above cause is in some cases very considerable, occasioning (when

it occurs in the Sublingual Gland) the disease called *Ranula*; as, from the Tongue being pressed upwards to the roof of the mouth, the patient articulates indistinctly, and his voice has a croaking sound, like that of a frog.

The Ranula sometimes attains a very large size; and when the Tumour increases suddenly, the Tongue may be forced so far back as to prevent inspiration.

The Ranula sometimes bursts, and discharges a fluid like the white of an egg. The disease cannot be cured, until the cause of the obstruction be removed.

Scirrhus of the Salivary Glands is by no means of rare occurrence; and but rarely leads to Cancer.

Salivary Concretions.

Stones of a white colour, and of different sizes, sometimes are found within the ducts of the Larger Salivary Gland. *

All of those represented in Plate XXVI. were obtained from the Salivary Ducts.

These substances, when chemically analyzed, have been found, by FOURCROY and VAUQUELIN, † to consist of phosphat of lime, united to a membranous substance.

* *Vid.* Plate XXVI.

† *Vid.* FOURCROY, IX. p. 367.

Dr BOSTOCK examined a Salivary Concretion weighing 1½ grain, which consisted of phosphat of lime, excepting a few films of matter, which were considered as coagulated albumen. ‡

Dr THOMAS THOMSON examined for me a calculus which stuck in the Tonsils, and which, in appearance, bore a very strong resemblance to Salivary Calculi, and which he found to consist of two parts of phosphat of lime, three of carbonat of lime, and a proportion of coagulated albumen. *

EXPLANATION OF PLATE XXVI.

In this Plate, several Calculi, extracted from the ducts of the Salivary Glands, are represented; the largest was extracted from the duct of the Inferior Maxillary Gland.

‡ *Vid.* NICHOLSON's Journal, XIII. p. 374.

* *Vid.* Morbid Anatomy of the Gullet, &c.

Organic Derangements of Muscles of the Tongue, Fauces, and Pharynx.

When the bolus of food has been masticated, and mixed with the Saliva, it is put upon the point of the Tongue, which is elevated; and by the Stylo-glossi, Mylo-hyoidei, Genio-hyoidei and Digastric muscles, the Pharynx is elevated, and at the same time expanded, in order to receive the bolus of food.

By the retraction of the Tongue, the bolus of food is pressed into the Pharynx. The Velum Pendulum is raised by its Levator muscles, by which the passage into the Nostrils is shut.

The pushing the Tongue backwards has the effect of pressing down the Epiglottis, and of thereby shutting the passage into the Windpipe, to which the elevation of the Larynx, which, from its connexion with the Pharynx, must be raised along with it, essentially contributes. Indeed, the elevation of the Larynx *is sufficient to shut the Epiglottis*, as may be seen in the dead body, by fixing the Tongue to the Palate.

Thus, the bolus of food passes into the Pharynx; and by the successive contraction of the muscular fibres of that organ and of the Gullet, it is propelled into the Stomach. That it does not descend into the Stomach on account of its weight, is obvious, from our being able to swallow solids, or even fluids, with body in-

verted; from a spasm or palsy of the Pharynx and Gullet causing impeded deglutition; and from animals generally feeding with the head lower than the rest of the body.

Such being the means by which the bolus of food passes into the Gullet, it follows, that when these muscles become paralytic, or are spasmodically contracted, or when any swelling or tumour obstructs their action, deglutition must be much interrupted, or wholly impeded.

The palsy and spasm of the muscles is sometimes only of a few hours duration; but, in other cases, it lasts for weeks or years. *

Organic Derangements of the Tonsils.

The Tonsils of the young and robust are extremely subject to inflammation. They are sometimes so much swollen, that the passage for the air through the nostrils is much obstructed, and also that of the food into the Gullet.

This inflammation is often succeeded by the formation of Abscesses, and sometimes, according to authors, by Gangrene; and more frequently by the exudation of a quantity of coagulable lymph. The Tonsils are sometimes filled by a sebaceous matter.

Calculi sometimes occur in the Tonsils.

* *Vid.* my Morbid Anatomy of the Gullet, Stomach, and Intestines.

Beside the above various organic derangements of the organs of manducation and deglutition, extraneous bodies frequently stick in the Fauces, Pharynx, or Gullet.

An extraneous body sticking in the Pharynx proves a source of inflammation and ulceration; and a Sac is formed for it, which, becoming more extensive, proves the cause of difficult deglutition. Flat bodies, as halfpennies, have in some cases stuck for years in the Gullet; but large bodies sticking in the middle of the Gullet, have proved a cause of instant death, by compressing the Windpipe.

Many bodies, after sticking in the Gullet, pass down into the Stomach, and prove the source of inflammation, and other consequences to be afterwards described.

CHAPTER II.

OF THE ORGANIC DERANGEMENTS OF THE STOMACH AND INTESTINAL CANAL.

Of Alvine Concretions.

THE term *Concretion* is very descriptive of the nature of these substances, which are composed of fibres intimately matted together.

These concretions are various in point of size. Some are not larger than a garden-pea; but others are as large as an orange; and some attain a much greater bulk, weighing three or four pounds.

The smaller Concretions are of a yellow colour, of an oval or rounded figure. The larger are more irregular, consisting of a number of lobes; and some of them seem to be composed of a congeries of smaller Concretions, and are covered by a white crust, which seems to be deposited in successive layers.

There are commonly only two or three Concretions formed within the human intestines; but sometimes a greater number.

Some alvine Concretions are porous, somewhat like dried sponge, and composed of fibres intimately interwoven with each other.

Some of the Concretions, when divided, exhibit lamellæ about two lines in thickness, and a central nucleus; but, in others, there is neither a nucleus nor lamellæ. *

There are small cavities within some alvine Concretions.

These alvine Concretions were analyzed by Dr THOMAS THOMSON, who communicated to me the following account of them.

" The calculi which I examined are of a much more compound nature than I expected, and contain two substances, of a nature quite peculiar, or at least with which I was not before acquainted. The following observations will convey a general idea of their nature and composition.

" 1. At first they swim in water; but that is owing to the numerous pores, filled with air, which they contain. Accordingly, they soon sink to the bottom, and remain there. The specific gravity I found to vary in different specimens, from 1.376 to 1.540. I consider 1.400 as about the average specific gravity of the whole.

" 2. When left in cold water, they soon communicate a brownish tinge. The water was found to have taken up the following substances:

L 2

* *Vid.* Morbid Anatomy of the Gullet, Stomach, and Intestines.

1. Albumen, which was separated in white flakes by boiling the water. 2. A BROWN SUBSTANCE, which I consider as peculiar. It dissolved at first in water; but became nearly insoluble, by the slow evaporation of the liquid. It dissolved in alcohol. It approached most nearly, in its properties, to vegetable EXTRACTIVE; but the quantity which I obtained was too small for an exact examination. 3. Common salt, which crystallized when the water was allowed to evaporate spontaneously in an open vessel. 4. Phosphate of lime, which was precipitated by ammonia. 5. Sulphate of soda, in a very minute proportion. 6. Perhaps also sulphate of lime; but the quantity of this salt must have been very small.

" 3. Alcohol dissolved the peculiar brown matter, and some of the salts, but extracted nothing particular.

" 4. Potash ley separated the albumen, the brown matter, and perhaps some of the salts.

" 5. Muriatic acid separated a notable proportion of phosphate of lime.

" 6. After the action of all these reagents, there remained behind a peculiar substance, having the colour and texture of the calculus. Ten grains of calculus left 1.2 grains of this matter. It was very light, and had the appearance of cork, or rather of the peculiar fungus which is used on the Continent for tinder, and which the French call Amador. It was in very short threads. This

substance is tasteless, insoluble in water, alcohol, ether, potash ley, and muriatic acid. It blackens sulphuric acid, and is dissolved, being partly reduced to charcoal. In nitric acid it dissolves very slowly, and only when assisted by heat; and hardly effervesces. When the solution is evaporated to dryness, a whitish residue remains, which has a bitterish taste, and is imperfectly soluble in water. Nitric acid does not convert it into any of the vegetable acids, though digested on it repeatedly. This substance burns with a slight flame, and rather like a vegetable than an animal body. It is undoubtedly of a peculiar nature, differing from every animal and vegetable substance hitherto examined. Its insolubility in potash ley distinguishes it readily from Wood. It has no resemblance to any animal substance whatever.

" 7. The calculi consist essentially of alternate layers of this peculiar substance, and of phosphate of lime. Sometimes the substances are intimately mixed, instead of being in alternate layers. The albumen and brown matter seem to serve as a cement. The other substances are in a small proportion.

" The crust on the outside of some of the calculi consists of phosphate of lime, mixed with a brown animal matter.

" In a few specimens, I observed crystals of phosphate of ammonia and magnesia, upon the outside crust of the calculi; but these appearances are uncommon.

" Such are the constituents of the calculi, as far as examined. I have retained thin slices of two or three, and mean hereafter to ascertain the proportions of the different constituents with exactness. In two calculi, the phosphate of lime amounted to rather more than half the weight of the whole. In one specimen, the albumen separated was one twenty-seventh of the whole; but I have reason to believe that a portion still remained. The quantity of common salt, and sulphate of soda, was small. I could detect no potash by the test of muriate of platinum. Neither was there any ammonia present, or carbonate of lime, both of which I expected to find. I examined the calculi carefully for uric acid, but found none. Neither could I detect any uvea. These substances abound in urinary calculi.

" The preceding details are sufficient to show, that the calculi in question are of a very *different nature* from any hitherto examined. They are of a much more *insoluble nature* than urinary calculi. Indeed no solvent exists, except of a nature so corrosive that it could not be applied. "

Alvine Concretions derange the functions of the Alimentary Canal, by obstructing it.

In some cases, the Concretions pass from one part of the Inteftines to another; and at length stick immediately above the Sphyncter Ani, or they are discharged by stool.

But more frequently the Concretion sticks in a certain part of the Intestines; which is in pre-

cess of time expanded into a Sac, within which the Concretion is firmly retained by coagulable lymph effused upon the Villous Coat of the enlarged Intestine, insinuating itself into the unequal surface of the Concretion.

Of the Effects of Arsenic and its Oxydes upon the Human Frame, when taken into the Stomach.

Arsenic, when taken in its pure metallic state, is not so poisonous as its oxydes. I made several experiments upon dogs; and found, that six, or even eight, grains of the metallic arsenic might be given to a dog with impunity.

The Arsenic acted as a very *powerful cathartic* and *diuretic.*

The black oxide of Arsenic produced, by exposing the metallic Arsenic, when minutely divided, to the air and moisture, a very deadly poison; for a single grain of this excites violent vomiting of bile and blood, followed by death.

The white oxyde of arsenic is equally deadly; and upon dissection, the Stomach is found violently inflamed, eroded, or rather as if perforated by a sharp instrument; which perforations are surrounded by a red line, and in some places gangrenous.

I found also, that an artificial Sulphuret, composed of equal parts of sulphur and arsenic, might be given, to the extent of ten or twelve grains, to a dog with impunity; but that a larger quantity occasioned the most violent symptoms.

Opium seems to prove fatal, by its effects upon the Nerves, and by being absorbed and mixed with the blood. *

Sect. I.

OF THE ORGANIC DERANGEMENT OF THE VILLOUS COAT OF THE ALIMENTARY CANAL.

Of Inflammation of the Villous Coat of the Alimentary Canal.

A part inflamed is generally of an unnatural redness, and swollen; but not always so. I have seen the Intestines of persons who died with all the characteristic symptoms of inflammation of the Intestines, of a sea-green colour; and, as a proof that inflammation had existed, the Intestines were covered by coagulable lymph, and blotches of a deep red colour.

The Villous Coat of the Alimentary Canal, when inflamed, commonly assumes a red colour, has a pulpy appearance, and is more sensible than usual.

The inflammation rapidly spreads along the Villous Coat, from the primary seat of the disease, and also to the other Coats. Covering the inflamed Villous Coat, we frequently meet with a quantity of coagulable lymph.

* *Vide* my Father's Experiments, Edinburgh Medical and Physical Essays, Vol. III. p. 292, &c.

In consequence of inflammation, the Villous Coat sometimes attains an unnatural thickness, owing to the effusion of a quantity of coagulable lymph. This sometimes fills the greater share of the Canal of the Intestine. Large pieces of coagulable lymph have been discharged by stool, which have been mistaken for monstrous worms.

Ulceration and Erosion of the Villous Coat.

These are the sequel of Inflammation. The Villous Coat of the Pharynx has sometimes been eroded from the Cynanche Pharyngea of Dr Cullen, or from organic strictures.

Ulceration is more common in the larger, than in the smaller Intestines.

The adhesive generally precedes the ulcerative inflammation; and hence unnatural communications have sometimes been established between neighbouring parts; as between the contiguous horns of the Intestines, between the Stomach and Colon, or between the Stomach and the Parietes of the Abdomen, and between the Windpipe and Gullet.

Gangrene is also an effect of inflammation.

The part affected by it emits a fœtid odour, assumes a black colour, tears like a piece of wetted paper; and the veins of the part do not fill again after the blood has been pressed out, coagulation having taken place.

Of the Appearances of the true Dysentery.

Inflammation of the great Intestines is often observed; and there are black spots upon the Curvum, (commonly called Rectum), upon the Colon, and even on the smaller Intestines. *

On an accurate examination, these black spots were found to be owing to black blood diffused through the Cellular Membranes, situated between the fine internal Villous and the Muscular Coats of the Intestines; and in the middle of these black spots there was generally more or less of an erosion of the Villous Coat.

Ulcers to a considerable extent take place from long continued Dysentery; and sometimes a substance, like a slough, is discharged by the Intestines, which takes the form of the Intestines; it is merely coagulable Lymph, which has been effused in consequence of inflammation.

On raising the Villous Coat which covered these black spots, it appeared fine and transparent, though the Cellular Membrane below was black; and on dissecting away this black cellular membrane, the muscular fibres of the Gut appeared of their natural colour.

Sometimes I have observed ulcers of a considerable size in the Villous Coat of the Rectum.

* The following account of the appearances on dissection in Dysentery, is taken from a manuscript of my late uncle, Dr D. Monro.

In some subjects, there were some spots appeared on the outside of the Gut, which, upon examination, were found to be occasioned by extravasated liquors in the Cellular Membranes, between the Peritonæum and Muscular Coats of the Intestine.

From what I have mentioned of the black and livid spots which appear on the internal surface of the great Intestines, and of black or bloody fluids being diffused through the Cellular Membranes, and of the Villous Coat appearing transparent when raised from these black Cellular Membranes in places where it had not been eroded, I think there is no doubt but that the erosions of the Villous Coat are occasioned by Suppuration of those inflamed parts of the Cellular Membranes, or by a kind of Gangrene or Ulcer in them; though I think, from the accounts we have in authors, of the dissections of persons who have died of the Dysentery, it should appear that there is no part of the Alimentary Canal that has not been found inflamed, or in a state of Gangrene or Suppuration.

There may be observed, in some cases, on the inner side of the lower part of the Colon, and upper part of the Rectum, a number of little tubercles, or excrescences, which resemble the Small-Pox Pustules at the height of the disorder; but differ from them in this, that they are of a firm consistence, and without any cavity.

These Tubercles are sometimes cleft on their

surface, and somewhat resemble small warts. This appearance is only observed in the Camp Dysentery.

In my account of the diseases most frequent in the British Military Hospitals in Germany, I have mentioned the case of a Woman who died of the Dysentery, where the Intestines, and especially the Colon and Rectum, were inflamed, and the internal surface of the great Intestines mortified, and contained little vesicles, full of a putrid fœtid liquor, numbers of which she had evacuated by stool, some days before her death. An appearance somewhat similar to this, I saw in a patient who died of a violent Diarrhœa in the beginning of the year 1766, in St George's Hospital. On examining the body, there was a great number of small prominences found on the internal side of the Colon and Rectum, with erosions of the Villous Coat in the middle.

On squeezing these prominences, a number of vesicles of a mucous or gelatinous liquor, some of the size of millet seeds, and others larger, came through the eroded parts of the Villous Coat.

The Canal of the Intestines has been stated, by Rhodius,* to have been sometimes obliterated, in consequence of the adhesion of its opposite sides, when there has been an extensive ulceration from Dysentery.

* *Vid.* Rhodius, Mis. Cur. Obs. 508.

I have observed the Appendices Epiploicæ of the Colon and Rectum much enlarged in cases of Dysentery.

Scirrhous Tumours have been described by MECKEL, as being sometimes found within the Colon in cases of Dysentery. †

EXPLANATION OF PLATE XXVII.

This Plate represents two portions of Intestine, the Villous Coats of which had been ulcerated and eroded, in consequence of the Camp Dysentery.

SECT. II.

OF DIFFERENT KINDS OF TUMOURS CONNECTED WITH THE INNERMOST COAT OF THE ALIMENTARY CANAL.

Of the Milt-like Tumour of Mucous Membranes.

A Tumour somewhat similar to the Milt of Fishes sometimes grows from Mucous Membranes.

The Milt-like Tumour, in many respects, resembles the milt of fishes. It is of a pale red colour; and it also is nearly of the same consistence, but rather softer, and has an irregular sur-

† *Vid.* MECKEL, extra Comment. Leipsick, Tom. XV.

face, and is covered by a thin membrane, upon which there are a number of vessels filled by red blood.

This species of Tumour very readily falls to pieces, and mixes in part with water, forming a turbid mixture; and it is somewhat hardened by being put into strong spirits. It adheres but slightly to the organ from which it grows, by a number of small processes, which insinuate themselves into the Villous Coat which has attained an unnatural thickness; and when the Tumour has been detached, the Villous Coat of the diseased bowel assumes somewhat of a honeycomb appearance; and it is besmeared by several drops of blood, which are derived from the vessels which extended to the Tumour being torn.

The bowel from which such a Tumour grows externally, betrays marks of inflammation. There is evidently an unnatural determination of blood to the seat of the disease; the bloodvessels upon the Peritoneal Coat being not only larger, but also more numerous than in the healthy state.

The neighbouring Lymphatic Glands also partake of the disease, being much larger than in the healthy state, and are filled by precisely the same milt-like matter. In a case which I have had occasion to examine, where the Bladder was filled by the milt-like matter, one of the Lymphatic Glands at the side of the Bladder, had attained the size of the first; so that I at first supposed there had been an unnatural contraction in the

middle of the Bladder; but found, upon opening the Bladder, that there was no communication between the cavity of the Bladder and the unnatural swelling connected with it.

There is another peculiarity in the disease, viz. a very remarkable offensive fœtor; and the organ containing such a Tumour, is as much discoloured, and emits as fœtid a smell, as the same bowel which had been exposed to the air for several days.

Of Polypi.

Polypi sometimes grow from the Mucous Villous Coat, of which there are the following varieties.

The first is a circumscribed Tumour, compressible, and moveable upon blowing the nose, of a round or oval form, of a grey or light-brown colour, semitransparent, with a number of blood-vessels distributed upon its surface; soft to the touch, easily torn, sometimes solid, sometimes hollow, and filled by a slimy mucus; much affected by the state of the weather, shrinking in dry weather, and expanding in moist weather; and when partially destroyed, it rapidly grows again.

Such Polypi generally grow from the Ossa Spongiosa of the Nose, or from the Vagina.

This kind of Polypus frequently becomes partially inflamed, by which it sometimes contracts

adhesions with the cavity within which it grows, and then seems to have several roots. This kind of Polypus very seldom degenerates into Cancer.

RICHTER has described a variety of this Polypus, which is tough, and of a pale colour; and there is a viscid secretion from its surface. *

The second kind of Polypus is generally a small circumscribed Tumour; sometimes it has a narrow, and sometimes a broad basis, of an oval or pyriform figure, of a red or dark purple colour, perfectly opaque, of a fleshy consistence; hard to the touch when within reach; not easily torn, nor moveable on blowing the nose; not at all affected by vicissitudes of the weather. Sometimes it is stationary, then grows rapidly, and attains a large size; becomes very painful; sometimes discharges a bloody Mucus, and sometimes bleeds when touched.

This kind of Polypus often grows from the Posterior Nares, from the Pharynx, Gullet, Stomach, Intestines, and Uterus.

There are, in some cases, repeated discharges of blood from the Tumour when it is irritated, by which the patient's strength is much exhausted.

Polypi, in many cases, fill up the cavity in which they are implanted; sometimes extend beyond it; and the projecting part expands to a much greater size than the body of the Tumour.

* This kind is most frequent in the Nose; and is rather an elongation or relaxation of the Mucous Membrane of the Nose, than a Polypus.

Owing to the continued pressure of the Tumour, the Membranes ulcerate, and the neighbouring Bones are sometimes destroyed. Thus, when the investing Membrane of the Ossa Spongiosa of the Nose is destroyed, the bones become carious, for they cannot, on account of their thinness, exfoliate.

Sometimes the bones of the Nose are disunited.

This kind of Polypus, when divided, is found to be solid, and in some places fibrous; and resembles, in colour and consistence, the unimpregnated uterus, and is pierced with numerous blood-vessels.

There are a few small cavities in some of these Tumours, * which are filled with Lymph. †

There is a third kind of Polypus, which is soft, in colour resembling coagulated blood, and discharges blood even upon being slightly touched; and, in the old and debilitated, frequently degenerates into Cancer.

Of Fungous Tumours.

Fungous Tumours have been observed in every part of the Alimentary Canal.

Such Tumours are generally of a small size; of a very soft consistence; bleed when torn; and generally are composed of several lobules.

* Vid. Plate XIII. of my Thesis, De Dysphagia.

† Vid. Plate XIII. of my Thesis, fig. 1st; 3d, and 4th.

I have seen the Uvula and upper part of the Pharynx covered by a crop of such Tumours, of a small size; and the Membrane from which these grew, was of a dark purple colour; seemed considerably thickened; and was in some places eroded. Ulceration also sometimes takes place; and the Fungous Tumours often assume a malignant aspect.

My Father met with a case of Fungus of the Pharynx, which occupied a considerable share of the Internal Membrane of the Pharynx, and also of the upper part of the Gullet, which was thereby very much thickened, and the patient died from inanition: An Ulceration had taken place in some of these Fungous Excrescences.

Dr BAILLIE has described a case of Fungus of the Pharynx, which, when cut into, appeared to have a fibrous structure, disposed in some measure at right angles to the Inner Membrane upon which it was formed, and was ulcerated on its surface.

RAZOUX has described what he calls a Fungous Tumour. " Nous trouvâmes une espèce de *fungus* d'un pouce et demi d'épaisseur, qui bouchoit exactement l'orifice inférieur de l'estomac; c'étoit une excroissance formée par plusieurs couches l'une sur l'autre, qui partoient toutes du pilore, comme d'une racine ou d'un pédicule commun, et venoient s'épanouïr sur la surface de l'estomac. Ce *fungus* étoit composé de cinq à six couches assés distinctes d'une substance membraneuse et

charnuë; elle étoit dure en certains endroits, et paroissoit presque calleuse." *

In ten cases, my father found the Villous Coat of the Stomach or of the Intestines in a Fungous state, when before death there had been a discharge of a large quantity of black Bile.

When the Villous Coat has been reduced to this condition, it assumes a pulpy appearance, is much softer, thicker and redder than usual, and very irregular on its surface.

The distinction between the sound and diseased part is generally very manifest, the latter having at its edges a puckered appearance.

Fungous Tumours of different sizes, some nearly as large as small walnuts, sometimes pass across the bowel within which they are lodged.

The Villous Coat has sometimes been reduced to a Fungous state, when albuminous matter has been deposited between the Coats of the Stomach; and still more frequently in cases of Scirrhus, or Cancer of the Gullet, Stomach, or Intestinal Canal.

* *Vid.* Tables Nosol. &c. p. 279.

EXPLANATION OF PLATE XXVIII.

This plate, which was engraved from a very highly finiſhed drawing by Mr Syme, gives a very good idea of the nature of a Fungous Tumour of the Villous Coat of the Stomach. The Stomach was divided nearly perpendicularly, with the view of exhibiting the Morbid state of the Coats of the Stomach, and the degree of contraction at the Pylorus, produced in consequence of the deposition of matter like the white of an egg between the Villous and Muscular Coats of the Stomach, which had forced inwards the Villous Coat.

The albuminous matter is not of an equal thickness in every part of the Stomach; it is considerably thicker at the Pylorus; and formed Tumours which had the effect of straitening the passage through the Pylorus very considerably.

The Coats of the Duodenum were in a sound state.

All the neighbouring Glands were much enlarged, and there was an unusual determination of blood to them.

A and B represent the Cardiac portion of the Stomach, where the Villous Coat is in a sound state.

C and D point out the Fungus of the Villous Coat.

F, G, H, I, point out the Glands connected with the Stomach, which were in a diseased state.

K, the Duodenum in a sound state.

Of Hæmorrhoids.

Hæmorrhoids frequently grow from the Rectum.

The more common kind of Hæmorrhoids are solid, incompressible Tumours, which are not painful on pressure, and which are of different sizes.

Tumours composed of a Plexus of Veins, which are of a purple colour, soft and compressible, and which discharge blood, are sometimes met with in the Alimentary Canal, and which have been described by some authors as Hæmorrhoids.

Of Aphthæ.

Aphthæ are white specks, about the size of a millet seed, and surrounded by a red circle; but sometimes they are of a dirty yellow or green colour, which frequently appear on the Mouth, Palate, and back of the Tongue; but at other times they extend downwards to the Gullet, Stomach, and Intestines.

Villous Coat, Cartilaginous, or Osseous.

Small pieces of Cartilage and Bone have occasionally been observed upon the Villous Coat of the Alimentary Canal.

Of the Organic Derangements of the Cellular Coat of the Alimentary Canal.

The Cellular Coat of the Inteſtines sometimes partakes of inflammation, which had begun in the Villous Coat, and which sometimes passes on to suppuration; by which abscesses of different sizes take place.

A quantity of a solid substance, like the white of an egg, is in some instances deposited in the Cellular Coat of the Alimentary Canal; by which the affected part attains an unnatural hardness and thickness, as in Plate XXVIII.

Organic Derangements of the Muscular Coats of the Alimentary Canal.

The Muscular Coats of the Alimentary Canal become sometimes paralytic, or are spasmodically contracted; and the Palsy, or Spasm, is generally a partial affection, occupying a small part of the Alimentary Canal.

The Spasm, or Palsy, is generally of short duration; but, in other cases, it lasts for several months, or even for years.

A Spasm, or Palsy, sometimes occurs in the Stomach, and in the Intestines; the former occasioning Colic.

Of the Organic Derangements of the Peritoneal Coat of the Alimentary Canal.

The Organic Derangements of the Peritoneal Coat are, Inflammation, which is often succeeded by the effusion of Coagulable Lymph, and Adhesion.

Ossification is also sometimes observed in the Peritoneal Coat.

Stricture of the Alimentary Canal.

The Stricture is a temporary or permanent disease; the former originating from an Inordinate Spasmodic Contraction of the Muscular Coat; the latter from a Permanent Organic Derangement of some part of the Alimentary Canal.

It seems not improbable, that both these very opposite causes of Obstruction are occasionally combined; as all patients who labour under a Permanent Obstruction, suffer occasionally from a considerable aggravation of the symptoms.

Beside the species of Stricture, occasioned by the Villous Coat only, which has already been described, there are two kinds of Stricture, in which all the Coats of the affected part are more or less thickened, and also indurated.

The 1st may be called the Inflammatory; the 2d, the Cartilaginous, or Scirrhous Stricture. The first is met with at all periods of life; is often the

immediate consequence of acrid substances being swallowed, of concretions, of dysentery, and of external violence; and it appears in a short time after the violence has been inflicted. We meet with Strictures of this description in the Urethra, after repeated attacks of Gonorrhœa, and in the Biliary Ducts, from the irritation of Gall stones.

Upon dissection, we observe a thickening of all the Coats, especially of the Muscular Coats, at the seat of the Stricture; an effusion of coagulable lymph between them; and the bloodvessels at the seat of the Stricture, which were much enlarged, and distended by blood, form a network upon it; and there is also a quantity of turbid serum effused into the cavity of the Abdomen, when the disease is seated in the Intestines.

The second, or Scirrhous Stricture, is of slow growth; appears only in persons who are far advanced in life, of a sallow complexion, and who are disposed to cancer; or in those whose constitutions have been much impaired: and upon dissection, we meet with a constriction, of an inch in length, of a cartilaginous consistence, and in which there is no appearance of the Coats of the Alimentary Canal; all of these having been absorbed, and cartilaginous matter been deposited in their stead. This species of Constriction generally terminates in the Cancerous Ulceration. It is very easy to discover the seat of the Stricture; for that part of the Alimentary Canal which is

above the Stricture is much enlarged; whereas, that beneath it is much contracted; and by tracing either of the dilated or contracted portions, we soon discover a part of the Canal which seems much contracted, as by a cord having been put around it, and which had left a purple mark; and upon pressing this part, it feels heavy and hard.

Strictures generally take place at that part of the Canal which is naturally most contracted.

The part above the Stricture is much extended, often inflamed, ulcerated, and sometimes eroded.

Coats of the Alimentary Canal reduced to a Pulpy State.

This peculiar and rare organic derangement of the Coats of the Alimentary Canal, has not, as far as I know, been described by any writer on Pathology.

The affected part is much enlarged; and its Coats, which are much thickened, do not possess their usual firmness; but feel very soft and pulpy, though not of a black colour; are not dilatable, and emit a very peculiar sweetish smell. There is a quantity of dark-coloured and very offensive bile contained within the Intestines. The Mesenteric Glands are generally enlarged, and sometimes ulcerated.

Of Scirrhus and Cancer of the Alimentary Canal.

This organic derangement is generally limited to a part of the Alimentary Canal.

The part diseased has a contracted and irregular form, and feels, on pressure, hard and heavy.

The disease generally begins in the Mucous Glands, and is propagated to the Cellular substance, which is converted into a dense Cellular substance.

The Peritoneal Coat acquires an unnatural hardness, and resembles the coarser kinds of parchment, and, in some cases, acquires the transparency of horn; in others, it attains an unnatural thickness.

The muscular fibres of the Muscular Coat are seldom to be seen, and, when visible, are generally of a paler colour than natural, and are separated from each other by Cartilaginous Septa of different thicknesses in different cases.

The Valvulæ Conniventes at the seat of the disease are much thickened and enlarged; and frequently a number of Tumours grow from it towards the cavity of the Stomach, as in Plate X.

In many cases, the disease is slow in its progress; and a considerable time elapses before the Scirrhous Tumours have attained so considerable a bulk as to obstruct the passage of the food. But in other cases, the progress of the disease is much more rapid, which may perhaps depend

upon the greater or less irritation to which the diseased part is exposed.

In many cases of Scirrhus, the adhesive precedes the ulcerative process. Thus, life is maintained, though the Coats of the bowel, which has been primarily diseased, be destroyed by ulceration. Thus, for example, the Stomach adheres to the Liver before, and to the Pancreas behind.

If the Scirrhus be so situated as to interrupt the passage through the Alimentary Canal, as at the Cardia or Pylorus, the part above the Stricture becomes prodigiously enlarged, and its Coats are at first much thickened; but, after a time, they become thinner, and even ulcerated, and at length ruptured, by which an unnatural communication is established between the seat of the disease and the neighbouring parts.

Of Intus-Susceptio.

A portion of Intestine sometimes passes within another, carrying along with it its Mesentery. The Intestine is then in a state of Intus-Susceptio; and this proves a cause of considerable stricture, the included Intestine being in a contracted state.

It has been stated, that the internal Coat of the Intestine is sometimes invaginated, and forms a complete barrier to the passage of the Alimentary Canal; but this I never have observed.

The Intestine passes generally into that immediately beneath it, and sometimes in the reverse manner.

The frequency of the first species, may be readily explained from the natural peristaltic motion of the Intestines; whereas the latter can happen only when the peristaltic motion of the Intestine is inverted.

A part of the Intestine has been stated to fall within another, merely on account of its weight; but the case of Intus-Susceptio from below upwards, sufficiently refutes such a theory.

An Intus-Susceptio is not peculiar to any one period of life.

It is much more common during infancy than in manhood.

During infancy, the included portion of Intestine may, in most instances, be readily disengaged, there being no unnatural thickening or inflammation, and but a slight diminution in the calibre of the Intestinal Canal.

But in the adult, the disease assumes a very different, and much more formidable aspect. The displaced Intestine is firmly fixed in its unnatural situation, in consequence of inflammation, swelling, and the accretion of the parts. Indeed, the union between the containing and contained parts, is in some cases so intimate, that the included intestine cannot be withdrawn; nay, not even distinguished from the containing Intestine; * and there is at the same time a great contraction of the affected part.

* *Vid.* my Grandfather's Obs. on Intus-Susceptio. Edinb. Med. and Phys. Essays, Vol. II. Art. 27.

In the infant, it is not uncommon to meet with three, four, or five Intus-Susceptions at the same time; sometimes there is a much greater number, and all in the natural direction. In other instances, some are in the contrary direction; but in full-grown persons, such an appearance seldom presents itself.

The extent of the Intus-Susceptio, or of the quantity of Intestine received within the other, varies from one or two, to eight, ten, nay, twenty inches. *

Intus-Susceptio is much more common in the smaller, than in the larger Intestines.

The Caput Coli has sometimes been found within a part of the Arch of the Colon, or one part of the Arch of the Colon within another, or the under part of the Sigmoid flexure of the Colon within the Rectum, or the Cæcum; and the whole of the Colon sometimes passes through the Rectum, forming an external swelling, or Procidentia Ani.

An Intus-Susceptio most frequently takes place when the contiguous Intestines are of unequal diameter. Hence the termination of the Ileum sometimes passes within the Colon; and such a displacement very often proves fatal even to infants.

The portion of Intestine which is in a state of Intus-susceptio, has sometimes been discharged by stool, and the patient has recovered.

* *Vid.* Edinb. Phys. Essays, Vol. II. Art. 27.

Sometimes, though rarely, we meet with a Double Intus-Susceptio.

Of Herniæ, or Ruptures.

A Hernia may be defined to be a Tumour, unconnected with a wound, and produced by a bowel, or part of a bowel, which is not situated in its natural place; and the Tumour may be either external or internal. *

The Hernial Tumour, generally, is *external to the cavity with which it is connected*; and formed by the protrusion or prolapse of a bowel from the cavity within which it was originally lodged, through a natural opening preternaturally dilated. Hence such swellings appear at the Groin, Scrotum, Labia Pudendi, bend of the Thigh, and Navel.

The protruded bowels are included within a Sac, which is formed by the elongation of the membrane which lines the cavity from which the protrusion has taken place. Hence the impropriety of the term Rupture.

* The definition of Hernia given by BOERHAAVE in his Prælectiones Academicæ, of which HALLER was the Editor, is a very good one.

Herniæ) " Ita vocamus partium mollium ex membranis cavis coercentibus dislocationes in aliena loca, ut adpareat esse quasi luxationem partis mollis." — *Vid.* Tom. VI. p. 51.

Beside the above species of Herniæ, where the bowels have been protruded through what may be called natural openings, there are Ventral Herniæ of the belly, which appear where there is no natural opening : and in these cases, there is generally a rupture of the Fibres of the Muscles which constitute the Parietes of the belly.

There are also *Internal Herniæ*, of which there are the following varieties. 1st, There is an Internal Hernia, where there is a small Tumour ; as, when a part of the Intestines is engaged within the upper part of the Inguinal Canal. 2d, Where there is a Tumour which, on account of the thickness of its coverings, is in most cases scarcely perceptible ; as the Obturator and Ischiatic Herniæ. 3d, Where, at the commencement of the disease, there is in most cases no perceptible Tumour, but where, in consequence of the duration of the disease, a Tumour appears ; as the Perineal Herniæ. 4th, There has a species of Internal Hernia been described, but in my opinion improperly, when Stricture, amounting to Strangulation, has been made upon a part of the Intestines, in consequence of an unnatural aperture in the Diaphragm, of malconformation of the Omentum, Mesentery, Mesocolon, or of an unnatural Appendix to the Intestines.

The different Herniæ have been named from their situation, or from the contents of the Hernial Sac : Hence the terms EXOMPHALOS or UMBILICAL HERNIA, BUBONOCELE or INGUINAL

Hernia, Oscheocele or Scrotal Hernia, Merocele or Crural Hernia, Hernia of the Perineum, of the Foramen Ovale, and the Ischiatic Rupture.

The Mesentery being longer than the Mesocolon, the smaller Intestines are more frequently displaced than the larger, to which the vicinity of the Ileum to the Inguinal and Crural Apertures also contributes.

When the Hernial Sac is filled by a portion of the Intestines only, the Tumour has been called *Enterocele;* and when the *Omentum* is also included within the *Sac*, the term *Entero-Epiplocele* is used; and the terms *Hepatocele*, *Splenocele*, *Hysterocele*, *Cystocele*, are employed, when the *Liver*, *Spleen*, *Uterus*, or *Bladder of Urine*, form the contents of the Hernial Tumour.

The term Congenite has been used when the bowels are contained within the same Canal as the Testicle; and also as expressive of the period of life at which that kind of Hernia generally shows itself.

Of Inguinal Herniæ.

The bowels are frequently protruded through the Inguinal Canal; and the Tumour, which generally is situated before the Spermatic Cord, is covered by Skin, Cellular Membrane, or the superficial Fascia, and by the Cremaster Muscle; and the small branches of the External Pudic Ar-

tery, which is derived from the Superficial Femoral Artery, pass between the Skin and the Tumour; and the Epigastric Artery is situated between the Hernial Tumour and the Ossa Pubis. Sometimes the bowels do not pass through the Under Abdominal Aperture, but occupy the space between both the Upper and Under Abdominal Apertures.

The Tumour is generally small; it lyes before the Spermatic Cord; is covered by the Cremaster and the Tendinous Aponeurosis of the External Oblique Muscle; and the Transverse and Internal Oblique Muscles pass over the neck of the Tumour.

Sometimes, as in Plate XXIX, there is a large Tumour at the Upper Abdominal Aperture.

EXPLANATION OF PLATE XXIX.

This Plate represents a large Hernia, which was situated at the upper Abdominal Aperture, and in which the strangulation was occasioned by that aperture.

A. Represents the Hernial Tumour.

B. B. The Bowels passing into the Tumour.

C. The Omentum passing into the Tumour.

D. D. The Parietes of the Abdomen turned down.

When the Bowels only pass through the under Abdominal Aperture, the disease has been named Ventro-Inguinal Hernia; and the Epigastric Artery then is situated between the anterior Spinous process of the Ilium, and the Hernial Tumour.

When there is a malconformation of the Inguinal Canal, owing to a deficiency of the small connecting fibres, which arise from the Crural Arch, the Hernial Tumour is situated nearly as a Crural Hernia.

Of Crural Hernia.

In this Hernia, the Bowels are protruded through the Crural Aperture.

A Crural Hernia is generally of a small size, rarely larger than a walnut: in a few instances, the swelling can scarcely be said to form an external Tumour.

A Crural Hernia has not only the irregular surface of an Inguinal Lymphatic Gland, but also communicates the same sensation when pressed; indeed, the Hernial Tumour is, in many cases, in part covered by the Inguinal Glands.

The figure of the Hernial Tumour, when detached from the other parts, is very different from that of an Inguinal Hernia; it has a long narrow neck, of an uniform diameter, and then suddenly expands into a body, the breadth of which is generally greater than its length.

Crural Herniæ are generally filled by a portion of Intestine, and frequently by a process of Intestine which is somewhat like the finger of a glove; which has hence been called Diverticulum.

The Spermatic Cord and round Ligament are rather more than half an inch distant from the mouth of the Sac of the Hernia, and on the upper and Ilial side of it.

Of the Varieties of Crural Hernia.

There are several varieties of this disease.

1st, *The most common kind* of Crural Hernia is that in which the bowels are protruded through the CRURAL APERTURE into the Lymphatic Sheath, which is thereby much distended and protruded.

In this instance, the Hernial Tumour is situated on the Pubal side of the Femoral Vein, and is covered by the Fascia Propria, * which is ra-

* The Fascia Propria has been thus described by its discoverer, Mr ASTLEY COOPER. "A thin fascia naturally covers the opening, through which the Hernia passes, and descends on the posterior part of the Pubes. When the Hernia therefore enters the sheath, it pushes this fascia before it, so that the Sac may be perfectly drawn from its inner side, and the Fascia which covers it left distinct. The Fascia, which forms the Crural Sheath, and in which are placed the hole or holes for the absorbent vessels, is also protruded forwards, and is united with the other, so that the two become thus consolidated into one. If a large

ther thicker than the healthy Peritonæum, under which a small quantity of fat is found between it and the Hernial Sac.

The neck of the Hernial Tumour is covered by the upper insertion of the Falciform process of the Fascia Lata; and the Epigastric Artery is situated on the Ilial side of the Tumour, and about an inch from it.

In the second variety of Crural Hernia, the protrusion of the bowels takes place through an aperture in the membrane which passes across the CRURAL APERTURE; a Lymphatic Gland which had filled up that aperture, having been displaced, and pushed to the Ilial side of the Crural Hernia.

The stricture in this instance is sometimes occasioned by the sides of the aperture through which the protruded Intestine had passed. This variety is peculiar, in wanting the Fascia Propria.

The third variety of Crural Hernia is that in which the protruded bowels pass into the sheath surrounding the Femoral Lymphatics, and then escape by one of the apertures, through which the Lymphatic Vessels enter the Sheath, as has

Hernia is examined, this Fascia is only found to proceed upwards, as far as the edge of the orifice on the inner side of the Crural Sheath, by which the Hernia descends; but in a small Hernia it passes into the Abdomen as far as the Peritonæum, and forms a pouch, from which the Hernial Sac may be withdrawn, leaving this, forming a complete bag over the Hernia."

been accurately described by Mr A. COOPER. The Tumour has not a well defined edge, being covered by the Fascia Lata of the Thigh.

In this Hernia, the strangulation may be occasioned by the border of the Sheath.

The fourth is that variety of Crural Hernia where the Tumour passes through the Ilial side of the Lymphatic Sheath, into the Sheath of the Femoral Vein.

The Hernial Tumour is originally situated on the Pubal side of the Femoral Vein, having the semi-lunar fold of the Fascia Lata stretched across its neck; and the Epigastric Artery is situated on the Ilial side of the swelling; and its termination is placed in front of the Femoral Vein, distending the Sheath of that vessel.

In the fifth variety of this disease, there are two Tumours; the one escapes into the Sheath of the Vein, the other into that of the Lymphatic Vessels.

Mr A. BURNS discovered this variety; and from his preparation the figure above alluded to is taken.

In this instance, the Obturator Artery passed between the Herniæ, and encircled the Tumour next the Os Ilium.

Mr BURNS, speaking of this variety of Crural Hernia, has remarked, "When this happens in a person in whom the Obturator Artery comes off by the short origin from the Epigastric Artery, the former vessel will to a certainty encircle the

Pubal side of the neck of the Ilial Sac. If, however, the Obturator Artery and the Epigastric continue connected for a considerable distance from their origin; and if one Herniary Tumour pass into the Sheath of the vein, and another escapes into the common Sheath of the Lymphatics, then both Sacs will be transversed on their upper margins by the Obturator Artery, and the Tumour of the Lymphatic Sheath will likewise have the same vessel on its Pubal side. I have never seen this variety in the course of the Obturator Artery; but I dissected the body of an aged woman last summer, in which I found one Sac in the sheath of the Lymphatics, and another in the sheath of the Vein. In this subject, the Obturator and Epigastric Arteries came off by a short trunk from the external Iliac; and the Obturator, in its way to the Thyroid Foramen, encircled the neck of the Sac contained in the Venous Sheath. This new variety of arrangement of the Obturator Artery shows, that the general opinion respecting the safety of cutting toward the Pubes, in those cases where the conjoined trunk of the Epigastric and Obturator is short, is not well founded. In this female we have seen, that although the common trunk of these vessels be very short, yet from the Ilial Tumour descending into the sheath of the vein, the neck of that Sac is encircled by the Obturator Artery."

The *sixth* is a frequent variety of Crural Hernia. The displaced bowels, in the first place, de-

scend in a direction perpendicular to the Abdomen, and lye over the Pectineus muscle ; the Tumour is therefore very moveable. In consequence of the connexion of the Falciform Process of the fascia with POUPART's Ligament, and the duration of the disease, the Tumour is frequently reflected over the Crural Arch, and is covered by the superficial fascia, skin, and cellular substance only.

From the great looseness of the cellular substance at the sides of the Tumour, it extends laterally, so that the transverse is the longer diameter of the Tumour. This kind of Hernia sometimes attains a considerable bulk, as in the annexed Plate (which is only half the size of nature); or as in a case my Father met with, in which the Hernial Tumour was in size equal to both his fists.

In this variety of Hernia, the Hernial Sac is remarkably thin, &c. ; so that the vermiform contractions of the protruded portion of Intestine are visible, and the neck of the Tumour forms nearly a right angle with its body.

In the seventh variety of Crural Hernia, the protruded bowels primarily enter the sheath of the Lymphatic Vessels, and then pass through holes for the transmission of vessels in the Falciform Process, and in the Superficial Fascia. The Tumour is in a great measure immoveable, and bears a very strong resemblance to enlarged Inguinal

Glands. A central fluidity or elasticity in the Tumour, derived from the contents of the displaced portion of Intestine, is the chief circumstance which characterizes this variety of Crural Hernia.

The *eighth* variety of Crural Hernia cannot be distinguished by an external examination. In this, the Obturator Artery arises from the same trunk as the Epigastric Artery. The common trunk being an inch long, the Obturator Artery, in its course to the Obturator Aperture, sweeps around the neck of the Hernial Tumour on its *Pubal side.* I have met with three cases of this description.

On account of the small size of the Crural Ring, and unyielding nature of the surrounding parts, a considerable pressure is made on the protruded bowel; and it is more difficult to return the displaced parts than in Inguinal Hernia. The pressure very often causes acute inflammation; and hence the contents of the Tumour are frequently covered by coagulable lymph, which binds the contents of the Tumour to each other, or to the neck, or some other part of the Sac.

Umbilical Hernia.

In this Hernia, the Bowels are protruded through the Umbilical Ring, or at the side of the contents of the Abdomen.

This Hernia is most frequent amongst children, and women who have had several children; and

the Hernial Sac is remarkably thin, and sometimes ruptured.

Congenital Hernia.

In this Hernia, the protruded bowels pass down through the same canal as the Testes, in consequence of that canal remaining open; so that the displaced portion of Intestine envelops the Testicle.

Sometimes the protruded Bowels, and their containing Sac, are included within the Tunica Vaginalis Testis, as in the Hernia described by Mr Key.

There is a process of Peritonæum which passes through the under Abdominal Aperture of the female, over the round ligament of the Uterus, into which the bowels sometimes insinuate themselves. This has been called *Congenital Hernia of the Female.*

Ventral Hernia.

This kind of Hernia is occasioned by the rupture of a part of the Parietes of the Abdomen; for the Bowels are not protruded at any of the natural apertures in the Parietes.

Internal Herniæ.

Internal are much more rare than External Hernia, and occur from the Bowels passing

through unnatural apertures in the Mesentery, Mesocolon, or Diaphragm ; or by an unusual elongation of the Omentum; which passing around a portion of Intestine, produces symptoms of strangulation.

EXPLANATION OF PLATE XXX.

This Engraving represents a case, in which the bowels were protruded through the Mesentery, and strangulated.

The figures 1, 2, 3, 4, point out the successive turns of the Ilium.

Of Intestinal Worms.

TÆNIÆ.

Several species of Tænia or Tape-worm, are peculiar to the human body.

Before proceeding to the description of the species, it may be proper to make some general remarks on the Anatomical Structure of the genus, which, although chiefly drawn from the examination of Tænia Solium, may be considered as applicable to all the species.

Anatomical Structure.

This animal is covered by an elastic and porous membrane, which, when examined by a microscope, seems smeared with a tenacious liquid, which exudes through the pores.

Under the membrane, some scattering fibres of a white colour are seen, the external of which are fixed into the inferior margin of each joint, and are disposed in a longitudinal manner ; the inner set of fibres following a transverse course.

The Alimentary Canal, which takes its rise from the mouth, divides into two distinct Canals, which pass along the margins of the joints : and in the last joint, these Canals are impervious.

Besides these longitudinal marginal tubes, there are transverse Canals which pass across the inferior margin of each joint, and communicate with the longitudinal Canals.

These Canals were first injected by ERNEST. *

Besides the above Canals, there is a pretty large Canal in the centre of each joint, (which was injected with quicksilver by my Father, and which has been particularly described by Dr F. PALMER, in his Thesis), which divides somewhat like a tree into a number of small lateral branches, which communicate with the Lateral Oscula, by small openings.

* Vid. HALLER, Disput. Med. Vol. III.

This system of vessels is generally filled by a white fluid, and has hence been supposed to be subservient to the generation of the animal, and, on account of the course of its smaller branches, has been called the Arborescent Ovaria.

All the species of Tæniæ are said to be Hermaphrodite.

Knots have been frequently observed in the Worm, which has led to the supposition, that as two pairs of the Oscula were in contact, the Worm was in a state of copulation.

This worm consists of a head, a chain of articulations, and a tail formed of a round joint; these articulations are quadrangular.

The head is placed at the smaller, and the tail, which has an oval termination, at the larger extremity of the worm. There are some who do not admit that the terms Head and Tail are correct; because each joint has its proper vessels, and is probably a separate animal, and capable of existing, independently of the other joints.

The head is placed upon a sort of neck or contracted part of the worm, and when strictly examined by the aid of a microscope, seems somewhat of a square shape. In it there are five apertures. The one in the centre, which is circular, is the mouth of the animal, and is surrounded by a double margin, and a number of rays, which describe small portions of a circle, between which there are little projecting substances which pro-

bably serve the purpose of tentacula, for fixing the orifice of the mouth. There are four oval-shaped apertures placed near to the angles of the square-shaped head.

Species of Tænia.

Instead of adopting the arrangements of authors, I have resorted to nature, and selected from the Musuem of the University of Edinburgh, those specimens of this kind of worm, in which the different characters were most distinctly marked. From a careful examination of these, my ingenious friend and pupil, Dr W. E. LEACH, who is distinguished for his accurate knowledge of Entomology, drew out the following new specific characters :

1. TÆNIA SOLIUM. Articulis quadratis, elongato aut transverso-quadratis ; osculis pone medium insertis. *Leach*, MS.

Tænia Solium.—LINN. Syst. Nat. ed. XII. 1323. *Faun. Suec.* 2264.

Tænia Osculis Marginalibus. HOOPER *in Mem. Med. Soc. Lond.* Tom. V. p. 257. *Figura pessima.*

Tænia Elongata.—HERMAN, *Mem. Helminth.* hujus varietas.

Habitat in *Hominis Europæi* intestinis frequentissime.

This species, which is by far the most common, may be distinguished from all others inhabiting

the human body, by the situation of its mouth, which is invariably placed behind the middle of the lateral margin. The mouth is sometimes placed on the right, and sometimes on the left side indifferently. The form of the Ovarium affords no specific character, and is therefore omitted in this description. This worm is generally several feet, nay, even yards, long, and is seldom passed entire; single joints are often evacuated by stool, and were formerly supposed to be a distinct genus of worms, and sometimes called *gourd-worms*, *Vermes cucurbitini.*

2. T. DENTATA. Articulis brevibus, transverso-quadratus, posticè marginatis; osculis medio insertis; margine posteriori dilatato; ovariis obscuris. *Leach*, MS.

Tænia Dentata, capite acuminate sessili, articulis transversè striatis, omnibus dilatatis, brevioribus; osculo in marginis lateralis utriusque medio elatiore. *Batsch*, *Ban. Gmelin*, 3073.

Habitat ———— *Mus. Monro.*

3. T. LATA. Articulis brevissimis, medio nodosis, postice marginatis; osculis prominulis medio insertis. *Leach*, MS.

Tænia Lata, candida, articulis brevissimis, medio nodosis; osculis solitariis. *Linn. Syst. Nat.* XII. 1324.

Habitat in hominis intestinis in Britannia rarissime; in Russia et Helvetia frequentior.

These three species have the osculæ in the margin of the segments.

The last must not be confounded with the *Tænia Lata Osculis Superficialibus of* HOOPER in the Memoirs of the Medical Society of London, which certainly belongs to another genus, and is not, as he considered it, the *Tænia Lata* of LINNÆUS.

A species, under the name of *Tænia Vulgaris*, is noticed by LINNÆUS, as frequently occurring in Sweden, having two oscula on each joint; but as such has never come under my inspection, I can only quote the words of LINNÆUS: "Habitat in hominum intestinis, Suecia vulgatior, pertinasissimè infixa, ut violentioribus etiam remediis resistat; tenuis, laxa, quasi membranacea, Solio tenacior, vivens lactescens subpellucida, 10—16 pedes longa, et fine latiore ultra 4 et ½ lineas lata, articulis nunc quadratis nunc paulo magis oblongis, medio secundum longitudinem subtiliter striatis, ad latera transversè rugosis, ovariis florum corollam referentibus."

Having finished our account of the Tæniæ, we proceed to that of the Ascarides, or Round Worms.

Round Worms.

There are three species of Round Worms: the

Ascaris Vermicularis, *Ascaris Lumbricoides*, and *Trichuris Hominis.*

Ascaris Vermicularis.

Ascarides, when recently discharged, are nearly transparent.

This is the smallest, and most common species of Worm, and is found generally in the Rectum. They are about half an inch in length, and divided into three parts. The head, in which three vesicles may be observed, with an aperture in the middle, is obtuse, and the tail ends in a sharp point.

This Worm has a distinct cuticle, cutis vera, and annular muscles.

The male seems to have only an Œsophagus, Stomach, and Intestines. The Stomach is a round bag, situated at the sides of the Œsophagus; this, according to GOEZE, constitutes a distinguishing character of the species.

The male organs of generation have not as yet been detected.

In the female, the apparatus for generation is visible. It begins as a slender tube, from a small opening, which is situated near the middle of the body; it gradually becomes larger, and surrounds the Intestinal Canal.

The Uterus is not bifurcated as in the Ascaris Lumbricoides; and its end is as large as any other part of it.

Ascaris Lumbricoides.

This Worm has generally been called Lumbricus. It was formerly supposed to be the same as the Earth-worm, but it is very distinct.

It has a round body, and is generally from six to fifteen inches in length.

The smallest are whitish, and almost transparent, when examined soon after they have been passed; the larger are of a greenish yellow colour.

They are very prone to putrefaction; the largest sooner putrefy than the smaller. I have seen the largest burst in the course of a day or two after being voided.

The head is divided into three lobes, which are joined at their bases, betwixt which the mouth of the animal, which is of a triangular form, is placed. The Anus of the animal opens a little way from the extremity of the Worm, upon the under surface of the Worm, by a curved fissure.

The body has a rugose appearance; and there are four lines, placed nearly at equal distances, which pass along the animal. Two of these are much more apparent than the other, from being much broader.

By these lines, fibres, probably circular muscles, are intersected in such a manner, that each consists of two semicircular portions.

Anatomical Structure.

The animal has a strong, thin, elastic cuticle. The true skin is also elastic and transparent, and thicker than the former.

The muscles, which are seen through the skin, do not surround the Worm, but are, according to Dr Hooper, two distinct sets of muscles which act in opposition to each other; and each of the two longitudinal lines, which extend from the head to the tail of the Worm, are composed of two distinct tendons, which serve for the attachment of the Semilunar Muscles, which cover the whole of the Worm.

The cuticle and true skin are so transparent, that I have been able to distinguish the sex of the animal through these.

The Abdomen, which is lined by a fine membrane, which may be called Peritonæum, contains a transparent fluid, the Intestinal Tube, and an apparatus subservient to generation.

The Œsophagus, at its beginning, is small. It continues increasing in size. In the Abdomen, where it may be called Stomach or Intestinal Canal, it is capable of receiving a common-sized surgeon's probe; and about a quarter of an inch from the Anus, it becomes narrower and straighter.

The Alimentary Tube is filled by greenish matter.

Some have supposed this Worm to be Hermaphrodite; but the sexes generally appear distinct.

I have remarked, that the females are larger, and more numerous than the males; and are generally in the proportion of four or five to one.

The parts of generation begin, or rather terminate, near the middle of the Worm, by a slender tube, which opens about the middle of the animal.

This tube soon becomes larger. It is then called Uterus. It divides into two Canals, which are considerably larger than the Uterus; then suddenly diminishes in size; and at last terminates in a number of small opaque threads, which float in the lowest part of the belly, and embrace the Intestines.

These smallest floating tubes are never empty, but are filled with an opaque fluid, in which there are a number of globular bodies floating.

In the male, the small tubes lead to a larger tortuous Canal, which may be called Vesicula Seminalis, which is rather more than an inch long, is unequal in its diameter, and follows somewhat of a tortuous course; and to the extremity of this, a conical shaped body, which may be called Penis, is connected by its base.

Some authors have supposed that these Worms are viviparous; which appearance is produced by

a part of the appendages of the Uterus having burst through the integuments of the animal.

As a proof that they are oviparous, I may add, that Ovula, in all respects similar to those found within the Uterus, have been detected in the Mucus surrounding the Intestines.

Trichuris Hominis.

This species is more rare than any of the above Worms. It was described and shown by my Father, in his Lectures in 1794, as an Intestinal Worm.

The body is about an inch long, and it has a filiform tail, about one inch and a half in length.

Different authors vary in their opinions respecting the anatomy of this Worm. According to some, the animal has a proboscis, which it can eject at pleasure. According to GOEZE, that is the Penis of the animal.

The Stomach and Intestines form a long Canal, which proceeds from the head to the extremity of the Worm; is largest at its beginning; and is much smaller at the tail of the animal.

The Ovarium, which frequently contains Ovula and a limpid fluid, is a convoluted Canal, and similar to that of the female Ascaris Vermicularis.

Besides the species of Worms already treated of, others of a very different description have been occasionally discharged by stool. I allude, in particular, to Caterpillars, or the Larvæ of Insects. *

Authors on the Organic Derangements of the Alimentary Canal.

ELLER, de Cognos. et Curand. Morb.
BAILLIE's Morbid Anatomy of the Human Body, 4th Edition.

* I sent, for examination, several specimens of them to Dr LEACH, who favoured me with the subjoined Report.

" They are all the Larvæ of Insects, as follow:

" No. 1. The ova of the Musca Vomitoria. My friend DONOVAN informed me, that he had seen the Larva of this insect in the intestines of a body (in Windmill-Street) in a state of putrefaction. The eggs most probably were deposited at the mouth, or anus; and the Larvæ had found their way thither, on their hatching, which soon happens.

" Nos. 2. 3. and 4. Larvæ of three unknown species of Coleopterous insects. No. 3. is figured in the Medical Journal, Vol. VIII. p. 48. fig. 8. I am pretty certain, that it is what the farmer terms the Wire-Worm. Of what insect it is the larva, will soon be made known, as Sir J. BANKS, at this time, is breeding a great many, in order to ascertain this important fact.

" Nos. 5. & 7. the Larvæ of Papilio Brassicæ, or some species much allied to it.

" No. 6. Pupa of some Musca.—Species unknown to me."

Du Haen, Ratio Medend. Vol. IV.
Morgagni, de Sedibus et Causis, Lit. XXXV.
J. G. Walter's Catalogue of his Museum.
Astley Cooper on Hernia. Lawrence on Hernia.
My Thesis de Dysphagia.
My Morbid Anatomy of the Gullet, Stomach, and Intestines, in which the different Authors on Particular Organic Derangements are quoted.

Authors on Intestinal Worms.

Phil. Trans. 1683.
Redi Franc. Osservazioni Intorno Agli Animali Viventi, che si trovano negli Animali Viventi. Firenze 1684.
Cler. Daniel, Historia Naturalis et Medica latorum Lumbricorum intra Hominem et alia Animalia, nascentium; ex variis Auctoribus, et propriis Observationibus, &c. Genevæ, 1715.
Pallas, Dissert. de Infestis Viventibus intra Viventia. Lugduni-Batavorum, 1760.
Fysche Palmer, Tentamen Med. Inaugurale De Vermibus Intestinorum. Edinburgi, 1766.
Andry, Traité de la Generation des Vers, 3ieme Edit.
Werner, D. E. F. Vermium Intestinalium, præsertim Tæniæ Humanæ brevis Expositio. Lipsiæ 1782. Continuatio prima, secunda, et tertia. Curante I. L. Fischer. Lipsiæ 1782, 1786, 1788. 8vo.
Goeze I. A. E. Versuch einer Naturgeschichte der Eingeweide-würmer Thierischer Koerper. Leipsig, 1787.
Bloch, Traité de la Génération des Vers des Intestins, et des Vermifuges. Strasbourg, 1788.
Brera, Lezioni Medico-Practiche sopra I Principali Vermi del Corpo umano vivente e le così dette Malattie

Verminose.—The figures of the Worms appended to this book, are by far the best which I have seen, and were drawn and engraved by ANDERLONI.

Entozoorum, sive Vermium, Intestinalium Historia Naturalis, Auct. CAROLO ASMUNDO RUDOLPHI. 3 Vol.

LINNEAN Transactions.

JOERDENS J. H. Entomologie und Helminthologie des Menschlichen Koerpers. III. T. Hof. 1801, 1802. Fol.

Engravings of Herniæ, and the Organic Derangements of the Alimentary Canal.

CAMPER on Hernia.

SOEMMERING on Umbilical Hernia.

Mr ASTLEY COOPER's Plates of the different kinds of Herniæ.

Plates annexed to my Observations on Crural Hernia.

Dr BAILLIE's Fasciculi of Plates, illustrative of his Morbid Anatomy.

The Plates in my Morbid Anatomy of the Gullet, Stomach, and Intestines.

PART V.

[illegible]

CHAPTER I.

OF THE ASSISTANT CHYLOPŒTIC VISCERA.

THE assistant Chylopœtic Viscera are, the *Liver*, *Spleen*, *Pancreas*, and *Omentum*.

SECT. I.

OF THE LIVER OF THE ADULT.

THE Liver, the largest gland of the human body, is of a dark red colour, inclining to yellow, and occupies the uppermost part of the cavity of the Abdomen, being in contact with the Diaphragm, and corresponding in shape with the under part of the Chest, by the cartilages of which it is covered and protected.

The size of the Liver varies a little in different individuals of the same age, weighing between two and four pounds Troy. The Liver of the Fœtus extends far beyond the margin of the Chest, and

occupies a very considerable share of the cavity of the Abdomen; and the younger the fœtus, the greater the bulk of the Liver.

The Liver is fixed to the neighbouring parts by the membrane called Peritonæum, which is described by anatomists as forming its Ligaments, though these bear no analogy to the other ligaments of the body.

The uppermost ligament of the Liver is in shape like a sickle, on which account it has been named the *Falciform Ligament*, or from its supposed office, *Suspensory Ligament*. This ligament may be readily seen by making incisions perpendicularly downwards from the breast bone on each side of the Recti Muscles, as far down as the Navel, and by then cutting across and raising the Recti muscles. It is thin and transparent, excepting at its under part; and extends backwards from the sheath of the Recti Muscles, and from the Ensiform Cartilage of the Sternum, becoming gradually broader, and is fixed obliquely to the Liver, where it divides into its two component layers, to form the *Lateral Ligaments of the Liver*, which are fixed to the right and left sides of the body.

The Umbilical Vein of the Fœtus, which is shrivelled, and changed into a rounded ligament, forms the under rounded part of the Falciform Ligament.

Between the layers of the Falciform Ligament, there is a small proportion of cellular substance,

and a number of Lymphatic vessels proper to the upper convex surface of the Liver, which pass upwards to the Chest.

The *Coronary or Posterior Ligament* of the Liver connects the middle of the posterior part of the Liver to the Diaphragm.

Besides the above reflections of the Peritonæum, there is a portion of the membrane which extends between the Liver and right Kidney, and which has been named by HALLER the *Ligamentum Hepato-Renale.*

The above author has also described a portion of the Peritonæum, which extends between the Liver and Gall-Bladder, across the Duodenum to the Colon, under the name *Ligamentum Hepato-Colicum.*

The above ligaments have been stated by some anatomists to retain the Liver in a certain place; but, during life, the Liver is supported by the contiguous bowels, and changes its place as they change their situation; it descends, for instance, when the Stomach and Intestines are empty, and during inspiration; and is pushed upwards during the latter months of pregnancy, and by diseases of the Viscera of the belly. Upon lying on the right side, the Liver is supported by the Cartilages of the false Ribs; but when we turn to the left, the Stomach is compressed by the weight of the Liver: hence we do not sleep so soundly on the left as on the right side.

The figure of the Liver is adapted to the form

of the under part of the Chest, within which it is placed, obliquely inclining downwards to the right side.

The upper surface of the Liver, which corresponds with the concavity of the Diaphragm, is, upon a superficial examination, convex upon its upper surface; but, upon a more minute examination, is found not to be perfectly uniform on its surface, for it is impressed by the heart, to which it is opposed.

The Liver is divided into *two great Lobes*, which, in the full grown person, are very unequal in point of bulk; that of the right side being much larger than the left.

The right Lobe occupies the right Hypochondriac Region, and a part of the Epigastric Region ; and is in contact with the Pylorus, Colon, and upper part of the right Kidney.

The left Lobe of the Liver is placed horizontally, and occupies a part of the left Hypochondriac and Epigastric Regions.

The under surface is much more irregular than its upper ; there are several remarkable eminences and fossæ, which are filled by Bloodvessels, and also depressions made by the contiguous Viscera.

The raising the Liver also exposes the very unequal thickness of this gland, which is thick and rounded where it is fixed to the Diaphragm by means of the reflection of the Peritonæum, called *Coronary Ligament*, but which becomes gradually thinner towards its fore part, which has hence

been named *its edge*; and it is also manifest that it declines in thickness from the right to the left side.

The edge of the Liver is inclined backwards, and does not describe an uniform line; but is notched; and opposite to the groove, which divides the Liver from before backwards, called *Fossa Umbilicalis.*

The more remarkable prominences on the under surface of the Liver are, a projection inclining downwards, and towards the right side, from its posterior thickened part; the figure of which is somewhat triangular, or somewhat like the tongue, but considerably thicker towards its base than its apex, which has been called *the third Lobe*, or *Lobule of* SPIGELIUS; and this Lobule rests on the Vertebræ between the Vena Cava and Gullet.

A rounded part of the Liver passes between the Gall-Bladder and passage for the Umbilical Ligament, downwards from the above Lobe to the right Lobe, serving to connect the above Lobe to the right Lobe; which, bearing a distant resemblance to the tail of an animal, has been named the *Processus Caudatus of the Liver.*

Upon the under surface of the right Lobe, there is a portion of the Liver which is somewhat of a square figure, or of the form of a parallelogram, which, from its shape, has been named the *Lobulus Quadratus*, or *Lobulus Anonymus* of HALLER.

In the concave part of the Liver there are ca-

vities for the bloodvessels, and also several depressions made upon the Liver by the contiguous bowels.

There is a large and deep cavity extending from before backwards, of which the large notch in the edge of the Liver constitutes the fore part; which, from containing the Umbilical Vein, has been named the *Fossa Umbilicalis.*

This Fossa runs backwards between the Lobule of SPIGELIUS, and the left Lobe, becoming narrower in its course backwards, where it lodges the *Canalis Venosus*, which, in the adult, like the Umbilical Vein, is converted into a Ligament.

The Fossa Umbilicalis is sometimes in part covered by a thin layer of the Liver, and thus formed into a distinct canal.

There is a much larger Fossa extending across the Liver in the transverse direction, called *Sulcus Transversus*; this large Fossa is bounded before by the Lobulus Anonymus, and behind by the third Lobe; which Lobes have deen described by authors as forming the Portæ of the Liver.

In this Fossa are contained, the trunk of the Vena Portæ, its two great Branches, the Hepatic Artery, Nerves, the common Biliary Duct, and many Lymphatic Vessels and Lymphatic Glands, united by Cellular Substance.

Between the third Lobe and right Lobe of the Liver; there is a Fossa for the Vena Cava, which vein serves in some measure the office of a Ligament.

The depressions upon the under surfaces of the Right Lobe, which lodge the Gall-Bladder, Hepatic Flexure of the Colon, Right Kidney, and Renal Capsule, and also that on the Left Lobe, which corresponds with the Stomach, merit attention, as pointing out the relative situation of one bowel to another.

The upper and under surfaces of the Liver are remarkably smooth, and have a shining appearance, being covered by the Peritonæum.

The Peritoneal covering is internally irregular, and intimately attached to a very thin Coat, which not only covers the surface, but also enters into the substance of the Liver, and may be seen passing around the larger branches of the Vena Portarum, on making a section of the Liver.

This second Coat seems to be merely condensed cellular substance, and does not exhibit a fibrous structure; and is not, like the Peritoneal Coat, elastic and extensible.

The substance of the Liver is very readily broken down.

On pressing the Liver between the fingers, it may be readily broken down; and a number of small hard bodies, of different figures, and about the size of a millet seed, may be perceived. These are what have been named the *Acini of the Liver*.

Of the Blood-Vessels of the Liver.

The Liver receives blood from two different sources; viz. from the Vena Portarum, and from the Hepatic Artery.

The Vena Portarum is formed by the junction of the Veins of the Chylopoetic Viscera.

It is a very peculiar vessel; for it is a vein, and formed by veins; but, like an artery, it divides into branches, which are distributed through the Liver, and, like arteries, perform secretion.

The Liver also receives blood by means of a branch of the Cœliac Artery, which has been called Hepatic; and which, when compared with the great size of the Liver, is but of small calibre.

SECT. II.

OF THE SOURCE OF THE BILE.

THE Bile has been commonly stated to be secreted from Venous Blood, which is of a dark colour; whereas, all the other secreted fluids are derived from the florid Arterial Blood.

It has been disputed, whether or not *Follicles* be interposed between the extreme branches of the Hepatic Artery, and Vena Portarum, and the origins of the Biliary Ducts; and also, whether all the Bile be derived from the Vena Portarum, or from the Hepatic Artery. My Father, who has devoted much attention to the structure of

Glands, and who has made many microscopical observations upon these, after filling, with great success, the Biliary Ducts, is of opinion, that the Acini of the Liver are *solely made up of cylindrical vessels.*

That the Bile is formed by the Vena Portarum, is no doubt probable from the very circumstance of an additional vessel being proper to the Liver; as well as *from the large size of that vessel*, which is capable of containing four times as much blood as the Hepatic Artery: beside, its branches are distributed over every part of the Liver, and communicate with those of the Hepatic Duct.

The Hepatic Artery alone has commonly been stated by authors to nourish the Liver. But there are several objections to such an opinion.

1st, Because the Vena Portæ of the Fœtus in Utero receives nutritious matter, and also probably oxygene gas, by the medium of the Placenta of the mother.

2dly, As my Father found, that after throwing a ligature around the Hepatic Artery of a living animal, and then cutting it, there was an adhesion betwixt the Liver and the side, which adhesion was supplied *with blood from the Vena Portarum.* Hence the branches of the Vena Portarum contribute to the nutrition of the Liver, in the same manner as those of the Pulmonary Artery contribute to the nutrition of the Lungs; as appears from a preternatural adhesion between the

Pleura Costalis and Pulmonalis being supplied with blood by the small branches of the Pulmonary Artery.

There is another peculiarity in the circulation of the blood of the Liver, which leads to the same opinion.

The veins which correspond with the Cystic branches of the Hepatic Artery, terminate in the Vena Portarum. Hence the blood is not exhausted of those principles which render it fit for the secretion of Bile.

My Father, who had always entertained the above opinion respecting the Hepatic Artery, endeavoured to prove it, by diverting the blood of an animal from the Vena Portarum; but his experiment proved fatal in so short a time, that no inference could be drawn from it.

Mr ABERNETHY lately discovered, in the body of a child, such a distribution of blood.

In that instance, the trunk of the Vena Portæ terminated in the Inferior Vena Cava; notwithstanding which, Bile was found in the Biliary Ducts, which could only have been derived from the Hepatic Artery.

The Bile is constantly secreted, and in greater abundance after a meal.

This I learnt from a case I attended, in which there was an abscess in the Liver, and a præternatural communication between the Liver and Lungs, through which all the Bile flowed, and was discharged by coughing; in proof of which,

the fæces were of the same colour, and had as little smell as those of a person deeply jaundiced.

The quantity of Bile discharged by coughing, was different at different times. It was *always greater after meals*, and especially for an hour or two after dinner. The quantity expectorated could not be measured with great accuracy, from being mixed with Mucus and Saliva. The whole quantity in twenty-four hours, was from ten to fifteen ounces.

I had also an opportunity of observing the effect of certain articles of food, and in particular of acids, as wine, and of different fruits, in increasing the quantity of Bile. *

A number of curious and very instructive experiments upon Dogs, have been performed by BICHAT; † which ſhow, that there is a constant

* The reader will find this singular case published at length in the 1st volume of the Edinburgh Medical and Surgical Journal.

† Voici ce que j'ai observé sur les chiens qui ont servi à mes expériences.

1o. Pendant l'abstinence, l'estomac et les intestins grêles étant vides, on trouve la bile des conduits hépatique et cholédoque jaunâtre et claire ; la surface du duodénum et du jéjunum teinte par une bile qui présente le même aspect ; la vésicule du fiel très-distendue par une bile verdâtre, amère, d'autant plus foncée et plus abondante, que la diète a été plus longue. 2o. Pendant la digestion stomacale, qu'on peut prolonger assez long-temps en donnant au chien de gros morceaux de viande qu'il avale sans mâcher, les choses sont à-peu-près dans le même état. 3o. Au com-

secretion of Bile; and a greater secretion of Bile than ordinary, a short time after food has been taken.

Sect. III.

OF THE BILIARY DUCTS.

By the medium of the smaller branches of the Hepatic Duct, which are distributed through

mencement de la digestion intestinale, on trouve la bile du conduit hépatique toujours jaunâtre, celle du conduit cholédoque plus foncée, la vésicule moins pleine et sa bile devenant déjà plus claire. 4o. Sur la fin de la digestion et tout de suite après, la bile des conduits hépatique, cholédoque, celle contenue dans la vésicule du fiel, celle qui se trouve répandue sur le duodénum, sont absolument de la couleur de la bile hépatique ordinaire, c'est-à-dire d'un jaune clair, peu amère. La vésicule n'est qu' à moitié pleine; elle est flasque, point contractée.

Ces observations répétées un très-grand nombre de fois, prouvent évidemment que telle est, pendant l'abstinence et la digestion, la manière dont se fait l'écoulement de la bile. 1o. Il paroît que dans tous les temps le foie en sépare une certaine quantité, quantité qui augmente cependant durant la digestion. 2o. Celle qui est fournie durant l'abstinence se partage entre l'intestin qui s'en trouve toujours coloré, et la vésicule qui la retient sans en verser aucune portion par le conduit cystique, et où, ainsi retenue, elle acquiert un caractère d'âcreté, une teinte foncée, nécessaires sans doute à la digestion qui va suivre. 3o. Lorsque les alimens, ayant été digérés par l'estomac, passent dans le duodénum, alors toute la bile hépatique, qui auparavant se partageoit,

every part of the Liver, the Bile flows into the large Hepatic Duct.

The Hepatic Duct, which is in size equal to that of a common writing pen, runs between the two layers of the smaller Omentum, enveloped in fat and cellular membrane, to the right of the Vena Portarum.

The Hepatic joins with the Cystic Duct at an acute angle, and forms the *Ductus Communis Choledochus*; which, when it approaches the Duodenum, is covered by the Pancreas.

This common Duct passes with a considerable degree of obliquity, for the space of about an inch, between the Coats of the second Flexure of the Duodenum; and a small projection marks the place of its entrance into that bowel.

The oblique passage of the common Duct through the Coats of the Duodenum, has the effect of a valve, and prevents its reflux from the Intestine.

coule dans l'intestin et même en plus grande abondance. D'une autre part la vésicule verse aussi celle qu'elle contient, sur la pulpe alimentaire qui s'en trouve alors toute pénétrée. 4o. Après la digestion intestinale, la bile hépatique diminue, et commence à couler en partie dans le duodénum, et à refluer en partie dans la vésicule où, examinée alors, elle est claire et en petite quantité, parce qu'elle n'a encore eu le temps ni de se colorer, ni de s'amasser en abondance.—Bichat, Anat. Gen. part. 1. vol. 2. p. 459.

Of the Gall-Bladder.

The size and figure of the Gall-Bladder vary much in different individuals; generally it is somewhat of an oval or pyriform shape.

The Gall-Bladder is placed obliquely, and fixed down by a reflection of Peritonæum; and its larger extremity is turned forwards and downwards; and when distended, it projects beyond the margin of the Chest, nearly opposite to the Cartilage of the second False Rib.

The Gall-Bladder has been divided by Anatomists into the Body, Fundus, and Neck. The Fundus, the larger extremity, is directed forwards, and a little to the right side, and corresponds to the excavation in the right Lobe of the Liver.

There are two Coats proper to the Gall-Bladder, viz. the Peritonæal and Mucous Coats; and between these, in some cases, very thin muscular Fibres may be observed.

Upon the internal surface of the Gall-Bladder there are a number of *Rugæ*, which cross each other, and form somewhat of *a honeycomb appearance*.

The neck of the Gall-Bladder is bent upon itself, and also its Duct, which is about 1½ inch long, and which is united to the Hepatic Duct at an acute angle.

The Duct from the Gall-Bladder called *Cystic*,

is smaller than *the Hepatic Duct ;* has somewhat of a knotted appearance ; and within it there are several longitudinal folds, which considerably lessen its canal.

The Arteries of the Gall-Bladder are derived from the Hepatic Artery.

Of the Structure of the Gall Ducts.

There are two coats proper to the Gall Ducts, an external fibrous coat, and an internal mucous lining ; and, in some robust subjects, between these, a few pale coloured and very thin muscular fibres may be observed.

Upon the inner membrane of the Ducts, the orifices of a number of mucous glands may also be observed.

Within the Cystic Duct, there are from fourteen to eighteen transverse folds, which are somewhat different as to breadth ; and also some folds which are disposed longitudinally, and which, by crossing the transverse folds, form Cells.

The same kind of structure may be observed in the Ductus Communis Choledochus ; but the Cells are not so manifest as in the Cystic Duct, the transverse plicæ being much smaller.

These Ducts are remarkably dilatable. I have seen them, from Gall-stone Jaundice, extended to three times their natural bulk.

SECT. IV.

OF BILE.

THE Bile is a viscid fluid, somewhat of a gelatinous consistence, and varies a little in its colour at different times; being sometimes of a golden colour; sometimes of a dirty yellow colour, inclining to green; and is to the taste bitter.

The Bile taken from the Gall-Bladder is perfectly similar to that of the Hepatic Duct in taste, colour, and smell, but is somewhat more viscid.

Bile is an animal soap.

Bile contains, according to Mr THENARD, some yellow matter suspended in it; and when evaporated to dryness, it leaves a brown matter, amounting to about $\frac{1}{11}$th of its original weight. The following substances, and the following proportions of these, were obtained by THENARD * from 1100 parts of human Bile.

1000.0 Water.

from 2 to 10 yellow insoluble matter, yellow matter in solution, a trace.

41.0 Resin.

42.0 Albumen.

5.6 Soda.

4.5 Phosphate of Soda, Sulphate of Soda, Muriate of Soda, Phosphate of Lime, Oxide of Iron; but no Picromel, like ox Bile.

* *Vid.* Mem. d'ARCUEIL. Tom. I. p. 53.

A very favourable opportunity lately occurred for examining Bile, which Mr JOHN DAVY examined at my request.

I have subjoined his account of it in his own words.

"*Healthy Bile obtained from a Person executed.*

"This Bile appeared, by transmitted light, of a fine golden yellow colour, darker and richer than the healthy Bile of the ox; and by reflected light it assumed the hue of burnt timber. It was rather more viscid, and also of greater specific gravity than ox Bile. The former, water being as 100, was found to be as 104.25, and the latter 102.75.

"It had nothing peculiar in its general properties, or different from those commonly observed.

"One hundred grains of it, slowly evaporated to dryness, afforded fourteen grains of solid residue, of a resinous appearance, and of a dark brown colour.

"This residuum, treated with alcohol, was completely dissolved with the exception of 1.5 grain, which had the properties of Albumen.

"The quantity examined was not sufficient for minuter analysis."

From the preceding results it may be concluded, that 100 parts of this human Bile contain about

86.0

86.0 Water.
12.5 Resin of Bile.
1.5 Albumen.

100.0

Sect. V.

OF THE SPLEEN.

The Spleen is an organ of a spongy consistence, of a livid colour, variable as to shape and length, generally approaching to an oval form; convex on its upper surface, which is received into a corresponding concavity of the Diaphragm; concave towards the Stomach, to which it is connected by the Peritonæum, Cellular Membrane, the greater Omentum, and by bloodvessels and nerves.

The Spleen occupies a share of the left Hypochondriac Region, between the left extremity of the Stomach and the false Ribs, but changes its place along with the Stomach, and also during inspiration.

The Spleen is generally about five or six inches long; but sometimes there is a larger, and one or two small Spleens.

The Spleen has two coats, one of which is derived from the Peritonæum; the other is proper to it, and but loosely connected to it.

The Spleen is also connected to the Pancreas by bloodvessels, and by the Peritonæum.

The Spleen receives, in proportion to its bulk, a large artery; and when the branches of that artery have been filled successfully, it seems to consist of a congeries of bloodvessels.

MALPIGHI has described little follicles interposed between the extremities of the Splenic Artery and the Splenic Vein; but I have never seen them.

The vein which corresponds with the artery is also of large size.

The Nerves of the Spleen, which are small, creep along the coats of the artery.

Nothing certain is known respecting the use of the Spleen.

SECT. VI.

OF THE PANCREAS.

THE Pancreas resembles the Salivary Glands in colour, consistence, and structure; and the liquor which is secreted by it is similar to the Saliva.

This conglomerate gland, which in figure has been compared to the tongue of a dog, is placed across the Spine, behind the Stomach, and is retained in its place by the root of the Mesocolon.

The Pancreas lyes before the Aorta, Vena Cava, and part of the Splenic Vessels, and also the edge of the transverse part of the Duodenum.

The Pancreas is about six inches long; and by its right extremity is connected to the left side of

the second turn of the Duodenum; from which part of it, there is a process called the *Lesser Pancreas*, which also is fixed to the Duodenum: and the left or smaller extremity is fixed to the Spleen by the Omentum Majus.

The larger Lobes of the Pancreas are composed of smaller Lobules, from each of which there is a *small Duct*; and these smaller Ducts unite and *form the larger Pancreatic Duct*, which begins from the left extremity of the Pancreas; and from the addition of the smaller branches it becomes gradually larger; and at the right extremity of the Pancreas the Duct of the smaller Pancreas joins the larger Pancreatic Duct.

To elucidate more fully the structure of the Pancreas, I have subjoined an engraving of that gland, as viewed by the microscope.

The Duct which has thin coats is placed in the middle of this glandular organ.

The large Duct generally enters the Duodenum along with, or near to, the Ductus Communis Choledochus.

De Graaf, a great many years ago, by fixing a tube into the Duct of this gland, discovered that the liquor secreted by it was in all respects similar to spittle.

EXPLANATION OF PLATE XXXI.

Fig. 1. represents the Pancreas, as seen by a common magnifying glass, after its Duct had been successfully injected.

Fig. 2. represents the Pancreas more magnified. And

Fig. 3. & 4. represent the Pancreas as seen under a microscope of very high powers, to show that there are no Acini in the structure of this gland.

The arteries of the Pancreas are derived partly from the Hepatic, but chiefly from the Splenic Artery.

The veins which correspond with these arteries assist in forming the Vena Portarum.

The Nerves of the Pancreas are small, and are derived from the great Sympathetic and eighth pair.

SECT. VII.

OF THE OMENTA.

THE Omenta are composed of Follicles, containing fat, connected to each other by cellular substance, and covered by the Peritonæum. The smaller is placed between the Liver, and smaller curvature of the Stomach; and the larger depends from the Spleen, the Stomach, and Colon, and in part covers the smaller Intestines.

The Peritonæum passes off double from the concave part of the Liver to the upper part, or lesser curvature, of the Stomach, forming what has been called the *Omentum Minus*, or *Omentum Hepato-Gastricum*. This is bounded on the right side by the large vessels which carry the blood into the Liver, and which are said to be enclosed in the Capsule of GLISSON; and on the left side, by the Oesophagus and upper orifice of the Stomach.

The two layers of the Omentum Minus separate from each other when they reach the Stomach, and give an external coat to that organ; then reunite; and by their continuation form the anterior part of the *Greater Omentum*.

The Greater Omentum hangs down from the greater curvature of the Stomach, and is fixed to the Colon, and therefore called *Omentum Majus Gastro-colicum:* And as a portion of the Omentum Majus extends farther to the right side than

the Stomach, following the Colon, that portion of it has been called *Omentum Colicum Dextrum.*

The layers of the Great Omentum separate from each other, and include the Colon. Hence, that part of the Omentum which hangs from the Stomach and Colon is quadruple.

The layers of the *Omentum Minus* separate from each other, on its right side, to inclose the Vena Portæ, Hepatic Artery, Biliary Ducts, and Nerves of the Liver, or to form what has been called the *Capsule of Glisson:* and hence, behind these vessels, *a hole large enough to admit a finger readily, is formed*, which was first described by Winslow, and has been called *the Foramen* of Winslow.

When the finger, therefore, is introduced into this hole, it passes behind the Omentum Hepato-Gastricum; and if, next, the finger be turned downwards, it passes downwards behind the Stomach, and then behind the fore part of the great Omentum; and then downwards behind it, to the upper part of the Colon and Mesocolon.

This hole, therefore, leads to a great Sac behind the lesser Omentum, then behind the Stomach and Omentum Gastro-colicum; and the Colon and Mesocolon form the bottom of the Sac; and at the back part of it the Pancreas is placed.

In a child, this Sac may be inflated from the Foramen.

In the human subject, the Omentum Majus, on some occasions, extends as far down as the

Navel; but in quadrupeds, whose hind legs are longer than their fore, it descends to the bottom of the belly; which renders it probable that a liquor, which lubricates and prevents the concretion of the bowels, is derived from the Omentum; though the Ducts through which it flows are not visible.

This organ varies in its bulk.

In the corpulent, it sometimes acquires a considerable thickness; but in the emaciated, the greater part of its fat is abstracted, and it assumes a reticulated appearance.

The under portion of this organ is loose, and readily changes its situation: hence, when the Intestines are protruded, it frequently forms a part of the contents of a Hernial Sac.

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PART VI.

CHAPTER I.

ON THE ORGANIC DERANGEMENTS OF THE LIVER, SPLEEN, PANCREAS, AND OMENTUM.

SECT. I.

On the Organic Derangements of the Liver.

THE Hepatitis, or inflammation of the Liver, a disease so frequent in tropical climates, and the great endemic of the Peninsula of *India*, was formerly supposed to occur but rarely in this country, or indeed in *Europe*; but I have seen a very considerable number of cases of it, though not in the more acute stage of the disease.

When we meet with it in this country, it is commonly only a partial and *a Chronic Inflammation*, which, being often mistaken by the patient for a derangement of the functions of the Stomach, passes on to suppuration before advice of the physician is demanded.

The pressure of the enlarged and inflamed Liver interrupts the functions of the Stomach; or

the same cause, impeding the free circulation of the blood through the different bowels of the Abdomen, as well as through the Liver itself, may produce a dropsy of the belly.

By means of inflammation, the enlarged Liver may be united to the neighbouring parts; and if, in such a situation, an Abscess should take place within it, the contents of that abscess might be discharged into the cavity of the Peritonæum, the Stomach, the Colon, or into the Sacs of the Pleuræ, or into the Lungs.

Abscesses of the Liver are of very various sizes. Sometimes the greater part of the Liver has been converted into a bag, containing purulent matter, or a fluid like the washing of flesh, or lees of wine.

The consistence of the purulent matter within the liver is very various. Sometimes it is thick and grumous; sometimes of a dark colour; sometimes limpid; and sometimes white, and, like that discharged by a scrofulous ulcer, with a red matter in it like the lees of wine, which is the heaviest part of it.

Mr Bogue observes, that the purulent matter has been discovered to be so very acrid, as to corrode the Cartilages of the False Ribs, and even the bony substances of the Ribs. The fluctuation of the matter is frequently very distinct. Sometimes it may be perceived at the extremity of the Ensiform Cartilage; as, from the weight of the matter, the Liver falls lower down than usual;

or along the right lobe of the Liver; or towards the Cartilages of the False Ribs, or below the margins of the Ribs. Sometimes the abscess encroaches considerably on the Chest, or even passes through the Diaphragm.

Gangrene of the Liver.

Gangrene of the Liver has been described as a sequel of inflammation of that organ.

Induration of the Liver.

The Induration of the Liver is sometimes connected with a diminution, but much more frequently with an enlargement of that organ.

Instead of employing, as the title of this chapter, the word *Scirrhus*, I have substituted the term *Induration*, in order to mark the distinction between the Induration of the Liver, and the Scirrhus of other glands, which diseases are widely different; for the Induration of the Liver never degenerates, like the Scirrhus of the Mamma or Testicle, into the Cancerous ulceration.

The usual weight of the Liver of the adult is between three and four pounds troy; whereas a diseased Liver has sometimes weighed ten or twelve, or even eighteen pounds.

When the Liver attains an enormous size, it elevates the Ribs sensibly; and, by its pressure upwards on the Diaphragm, greatly confines the respiration; and sometimes presses so much upon

the Lungs as to diminish their bulk, and even disturb the action of the Heart. The enlarged Liver sometimes descends as low as the Navel, displacing the Intestines, and deranging their functions as well as those of the Stomach.

In consequence of the partial enlargement of the Liver, one side of the Chest becomes more prominent than the other.

When the Liver is somewhat larger than usual, its ligaments are somewhat elongated and relaxed, by which it falls lower into the Belly than in the healthy state, and seems, before death, to be considerably larger than it proves to be upon dissection.

The enlargement of the Liver being generally partial, the diseased Liver does not retain its former shape; so that, instead of being concave towards the Stomach and Duodenum, it is often convex towards these organs, and presses on them very much.

The diseased Liver frequently contracts adhesions with the neighbouring parts. The inequalities on the surface are in some cases of such a magnitude as to be obvious by external examination.

Upon applying the hand to the Belly of a patient afflicted with this disorder, a pulsation may sometimes be perceived at the Scrobiculus Cordis, which is owing to the pulsations of the descending Aorta being communicated to the medium of the enlarged Liver.

The Gall-Bladder sometimes attains so large a bulk, as to project considerably beyond the margin of the Chest, and its Coats become thicker and redder than usual; but, in most cases, it contains but little bile, and is smaller than common; and its Coats are of a white colour, and much indurated. The Bile within the Gall-Bladder is generally, in such cases, found to be thin and watery, and not so bitter as usual.

The most common kind of Tumour of the Liver, is that which has been very faithfully described by Dr BAILLIE in the following manner.

" The Tubercles which are formed in this disease occupy generally the whole mass of the Liver, are placed very near each other, and are of a rounded shape. They give an appearance every where of irregularity to its surface. When cut into, they are found to consist of a brownish or yellowish white solid matter. They are sometimes of a very small size, so as not to be larger than the heads of large pins; but most frequently they are as large as small hazel nuts, and many of them are sometimes larger." *

When such tumours occur in the Liver, that organ loses its natural form. It becomes much thicker, especially at its edges; and also becomes heavier, though smaller in bulk, than the sound Liver, the Tumours being composed of very dense materials.

We meet with yellow-coloured Tumours both upon the surface, and within the substance of the

* *Vid.* Morbid Anatomy.

Liver. The substance of the tumour is commonly of the consistence of curd. The size of such tumours is extremely various; and generally they are of an oval or rounded figure.

The neighbouring Lymphatic glands generally partake of the disease.

The Liver, with such tumours, sometimes attains an enormous bulk. I have seen it fifteen or twenty pounds weight.

The Liver sometimes attains an unnatural bulk, from small soft tumours within it, which have been described by Dr BAILLIE under the name of *Soft brown Tubercles.*

There is another kind of tumour, of a deep chocolate colour, which rarely exceeds the size of a hen's egg, which I have seen in persons who died from the *Fungous Hæmatodes of some other part of the body.*

Osseous tumours sometimes occur in the Liver; and, in some cases, the ossification seems to have taken place upon the coats of Hydatids.

A swelling of the Liver has very frequently taken place from a collection of Hydatids within that organ.

By the term Hydatid, is to be understood, a round or oval-shaped semi-opaque pulpy bag, possessing a contractile power, without an external opening, of a pearly or yellowish colour, containing a watery fluid, and often a number of smaller Hydatids, included within its proper Capsule or Cyst.

Hydatids are of very different sizes; some are not larger than a millet-seed; others are equal in bulk to an ox's bladder.

The Coats of Hydatids are generally thin and semitransparent, although sometimes so thick as to be perfectly opaque.

The Habitat (to make use of the expression of modern naturalists) of Hydatids is also different. They have been discharged by vomiting, and by stool; frequently they are attached to the Peritonæum, and especially to that part of it which covers the Liver; or they are imbedded in that organ, or attached to the Kidneys or Ovaria, or to some part of the Alimentary Canal.

Hydatids have also, though more rarely, been found in the Cellular Membrane; likewise between the muscles; and sometimes, though still more rarely, within the bones.

There formerly existed a great variety of opinion respecting the nature of Hydatids.

Naturalists now seem to agree, that they belong to the animal kingdom, and constitute a Genus of animals, of which there are several species; but sufficient observations on recent or living Hydatids, have not yet been made, to enable us to draw up generic or specific characters. †

* Vid. Philosoph. Trans. Vol. XXII.

† The generic name of *Hydria* has been proposed; but no character of the genus has been established. It seems not improbable, that the Hydatids of the human body must form a separate genus, distinct from the Hydatids of sheep.

Hydatids, like Intestinal Worms, are incapable of independent existence, and therefore exhibit a contractile power only when examined immediately upon being discharged from a living animal. The remaining for many hours within the dead body, generally deprives them of the principle of life; and hence all specimens of Hydatids are not observed to contract; and such as retain the power of contraction for some time after being expelled, may be considered as unusually tenacious of life.

Purulent matter, which is sometimes lodged within the same Viscus, also proves fatal to Hydatids; and in this case, of course, they show no contractile power.

The Hydatids found in human bodies, are different from those of quadrupeds.

Of the human Hydatids, there are the following kinds.

First, Where there is only one large Hydatid of a globular form, contained within a Cyst. *

Second, Where there are several Hydatids within the same Cyst, of different sizes and colours; some being of a pearly, and others of a straw or amber colour; † and some of the larger of these are found to contain others.

* I met with a case in which eight English pints of fluid were contained within a large Hydatid; there were no small Hydatids within it; and the whole of the inner surface of the Hydatid was perfectly smooth.

† In another case, the Cyst of the Hydatid contained four

A third kind of Hydatid has been also described, but which I have never yet seen, where a number of Hydatids have been inclosed one within another, like a nest of chip-boxes.

The fourth kind may be called the Cellular Hydatid, as it is peculiar to the cellular substance of the muscles. The Cyst of this kind is of considerable thickness, and consists of several distinct layers, which sometimes acquire a cartilaginous hardness.

There is a fifth kind of Hydatids, which, from being compressed together, and forming a substance about the size of a garden pea, has been mistaken for indurated lymphatic glands. This kind has not, as far as I know, been described. The Hydatids are firmly united to each other by a very adhesive Mucus, and by a thin membrane, besides which, each of them is enveloped by its own proper capsule. These Hydatids are very small, being about the size of the Ovula in the Ovaria of fishes.

This kind is often found in the Choroid Plexus of the lateral Ventricles of the Brain, in cases of Apoplexy and Hydrocephalus.

pints of water, and a great many Hydatids of different sizes. Some were about the size of a nutmeg. Others, as large as a billiard-ball, floated loose within the largest Hydatid; and within several of the larger Hydatids, there were clusters of small spherical bodies grouped together, which adhered to their inner sides.

There is a sixth, though very rare sort of Hydatid, which also, so far as I know, has not been described. In this, the Hydatids are united laterally to each other. I have met with only two examples of this variety of Hydatids; and in both, they were connected with the Liver. There were, at the same time, a great number of Hydatids, of different sizes, attached to the Peritonæum, or floating about in the general cavity of the Abdomen. One of the patients, a boy, was supposed to labour under Ascites, his belly being enormously swollen, his breathing much oppressed; and he was not relieved by an erect posture. The superficial Veins of the Abdomen were greatly enlarged. For about nine months before his death, he had severe pain in the right Hypochondrium; and a considerable partial Tumour was observed in his belly, which increased with great rapidity for ten days before his death. Upon dissection, about four pounds of a fluid like tar ran out of the Abdomen. A large Hydatid was found adhering to the convex part of the Liver; and six others were found adhering to this. The Stomach was much displaced; the Pylorus being as low down as the brim of the Pelvis, and the greater share of the Intestinal Canal lodged within its cavity.

The watery fluid † contained in Hydatids, is

† According to Dr JOHN HUNTER, this fluid contains very small Hydatids, of different sizes, the largest being

generally transparent and colourless; is to the taste slightly salt; and in some instances, a part of it is coagulated by heat, or by the addition of acids, or ardent spirits.

In some cases, the contents of the Cyst are tinged with yellow, which is probably owing to an admixture of bile, exuding after death; for the yellow colour is observed only in Hydatids which are connected with the Liver and Gall-Bladder.

There are also Tumours, the contents of which seem to be Coagulable Lymph, and a number of Hydatids which have burst; and the Coats of those are shrunk and inverted.

There is a seventh kind of Hydatids, with narrow necks, which is frequently attached to the Placenta. I have also seen Hydatids of the second species connected with the Placenta.

Some of the bowels, as the Ovaria and Kidneys, are said at times to have been converted into Hydatids; but it would be more accurate to speak of the conversion of these bowels into watery vesicles, (the genuine Hydatid being rarely found within these bowels); and these Vesicles have only one Coat; they are not enclosed within firm Cysts, and do not produce their like; nor do they

one hundredth part of an inch in diameter, and the smallest being less than a red globule of the blood. *Vid.* Trans. for the Improvement of Medical and Chirurgical Knowledge, Vol. I. p. 38.

possess any degree of contractile power, like the genuine Hydatid.

Of the Sac of Hydatids.

The Sac of the Hydatid, seems to be formed of condensed Cellular substance; and the thickness of the Sac generally bears a ratio to its size and situation.

This Sac is secured in its place by several bands of Cellular substance, which pass between it and the bowel within which it is lodged; and in the Abdomen, it is covered by the Peritonæum.

The thickness of the Sac of a Hydatid is in proportion to its size; although there is a considerable difference in this particular, the Sac being thickest where it is most exposed. Thus, when the greater part of the Sac is surrounded by the substance of a bowel, as of the Liver, for instance, that part only of the Sac which is exposed is of a considerable thickness, and is sometimes cartilaginous, or covered by layers of bone.

I have observed, that the inner surface of the Sac is by no means uniform, but always somewhat irregular, and lined by a very thin layer of fat.

A glairy gelatinous liquor is also interposed between the Sac and the Hydatid, which prevents the Hydatids from being injured by friction.

The Sac of a large Hydatid is sometimes divided into compartments, which serve to prevent the smaller Hydatids, contained within the opposite ends of the Sac, from pressing upon each other.

Of the Coats of Hydatids.

The Coats of Hydatids are not of an uniform density, being much thicker in some, than in others; and even in the same Hydatid, we generally observe some portions of these Coats of greater density than others; so that, in the same Hydatid, there is a difference, as to transparency or opacity, in the different parts of its Coats.

Hydatids have two Coats, an outer and inner; and the outer Coat is considerably thicker than the inner.

There are no Fibres in the outer Coat of a Hydatid, visible to the naked eye; yet the outer Coat possesses the distinguishing character of a Muscle, —the power of contraction upon the application of a stimulus.

The inner Coat of the Hydatid is very thin, semitransparent, soft, pulpy, and very tender; and, in very large Hydatids, possesses a small share of elasticity. The interior surface is lubricated by a fluid, which renders it slippery to the touch.

From the inner side of some of the larger Hydatids, there are several excrescences, which are made up of a congeries of very small Hydatids; and the size of these bears a ratio to the size of the Hydatid.

These excrescences are retained in their situation by a very thin transparent membrane, which covers them.

There is still another appearance which I have remarked, viz. a number of small Cells formed by folds of the inner membrane of the large pregnant Hydatid, containing the small ones.

It has not yet been determined, what is the proportion of Hydatids which may be called pregnant.

In some cases, the greater part of the inner Coat is studded over with these small excrescences; but in other instances, there are only two or three such excrescences from the parent Hydatid.

Upon examining the Coats of very large Hydatids, even without the aid of a magnifying glass, very small Hydatids may be seen adhering to the Coats of the Hydatid; which would seem to show, that Hydatids are multiplied in the same manner as some of the Fungi of the Vegetable Kingdom.

Bloodvessels of Hydatids.

The Coats of Hydatids are provided with very small Bloodvessels, Absorbents, and Nerves.

The Bloodvessels proper to the Coats of the Hydatid, have no immediate connexion with those of the organ within which it is lodged. The Hydatid, in this respect, resembles a worm lodged within the human body.

I have, in several instances, filled, with great success, the bloodvessels of the organ within

which Hydatids were lodged ; also those upon the Sac of the Hydatid ; which, where the Hydatid is of considerable bulk, are of a large size, and which, like those in the neighbourhood of other preternatural tumours, acquire an unusual size ; but none of the injection got into the vessels of the Coats of the Hydatid.

But other authors have affirmed, that they had injected the vessels proper to the Hydatid.

Dr WALTER of Berlin supposed, that he had filled the bloodvessels upon the outer Coat of a Hydatid, which was contained within the Liver. But it is not improbable, that he had mistaken the vessels upon the Peritonæum of the Liver for those of the Hydatid.

Watery Vesicles, or Dropsical Cysts, as they have been named by some authors, are very different from Hydatids ; for in these we observe only a single thin Coat, firmly attached to the neighbouring parts, upon which several bloodvessels, filled by red blood, may be observed.

Such Cysts frequently adhere to the extremities of the Fallopian Tubes, to the ligaments of the Uterus, to the Choroid Plexus, to the Placenta, Kidneys, or are sometimes lodged within the Glandular Viscera ; and are also sometimes imbedded in the Mammæ and Testicle. I have seen them filled by a fluid of the colour of the Ink of the Cuttle Fish, when these organs have been reduced to a Scirrhous state.

Though the Arteries proper to the Coats of Hydatids be very small, yet the watery liquor which fills the Hydatid is secreted by them, and in some cases even bone.

The Hydatid is probably nourished by absorption, and not by continuous vessels from its Cyst, and may be compared in structure to the Echinus esculentus of LINNÆUS; that is, absorbent vessels take up its nourishment from the containing Cyst. And in like manner, the small Hydatids contained within a larger Hydatid, after being separated from it, or loosened from the Ovarium in which they were formed, suck up their nourishment from the liquor of the Hydatid which contains them.

By what vessels the liquor which has been absorbed passes into the cavity of the Hydatid, or forms young Hydatids, we do not know; probably such vessels exist as in the Echinus.

If Hydatids contract, upon the application of a stimulus, it must be granted, that these are under the influence of nerves; though these nerves be so small as not to be obvious to our imperfect senses.

Of the different States in which Hydatids are found.

Hydatids are found in different states.

The rudiment of the Hydatid is connected to the Coats of the pregnant Hydatids; and appears, with other small Hydatids, in the form of small

excrescences, which are attached to the large pregnant Hydatids.

After a time, these small Hydatids are detached from the parent Hydatid.

Hydatids are subject to diseases.

Hydatids sometimes burst within their Sacs.

We sometimes meet with Tumours, which are made up entirely of pieces of Coagulable Lymph and Hydatids, the water having been removed by absorption. Hence the Tumour does not communicate a sense of fluctuation, as when the Hydatids were entire.

The external Coat of Hydatids has sometimes been converted into Bone.

I have several preparations, which afford a striking illustration of the manner in which Bone is formed upon the Coats and Sac of Hydatids. The Ossification begins from a few central points upon the Coats of the Hydatid; and by subsequent depositions, the pieces of Bone gradually become larger and larger, so that at length a considerable mass of Bone is formed.

Of the manner in which the Cysts of Hydatids are formed.

The Sac containing the Hydatid seems to be formed in consequence of the irritation of the Hydatid.

In the same manner, where a large quantity of purulent matter has been contained within the

Viscera, we generally observe a Sac, provided with Arteries, Veins, Nerves and Lymphatics, as is obvious from the very varied contents of these different Sacs, and the spontaneous removal or absorption of their contents.

There are also similar instances in the Vegetable Kingdom, as in the production of Galls from the Oak, &c.

Of the Effects of Hydatids upon the Organs which contain them.

Hydatids which attain a considerable bulk, not only mechanically affect the organ within which they are lodged by their pressure, but, by the irritation which pressure gives, produce still farther changes upon it.

On account of the particular stimulus which Hydatids, as living animals, give the organ containing them, or to which they are attached, they undergo still farther changes, in consequence of an action excited, which perhaps may not improperly be termed *specific*: in proof of which, the organs within which Hydatids are contained, or to which they are attached, are sooner, and to a much greater degree, affected, than by the ordinary fixed Dropsical Cysts, whether of the natural or preternatural kind.

Thus, a large quantity of water accumulated in the Ventricles of the Brain, in Hydrocephalus Internus, sometimes occasions, in an infant, a disu-

nion of the Bones of the Cranium from each other, and the head acquires an unnatural bulk.

No part of the Cranium becomes soft, thin, or is absorbed. But if Hydatids are lodged in one of the Ventricles of the Brain, (which is not uncommon in Sheep), the Cranium over that Ventricle becomes soft, and may be cut without turning the edge of the knife, and loses considerably of its thickness; and in some cases holes are formed in it, although the Dura Mater remains entire between the Cranium and the Brain; and even although the Cyst containing the Hydatids is still covered by a seemingly sound portion of the Brain and Pia Mater.

The same happens in the human body; for in the case stated, * where a Hydatid, of the size of a goose's egg, was found in the right Ventricle of the Brain of a man, covered by a Gelatinous matter, without any fibrous adhesion to the membrane lining the Ventricle, the Cranium was found to be much thinner on its right side than on the left; and, in particular, the Right Parietal Bone was not thicker than a wafer.

In like manner, the Pleura, Peritonæum, and Vaginal Coat of the Testis, have been greatly extended for a length of time, but the containing membrane continues entire; whereas, when Hydatids are collected within these membranes, a

* *Vid.* Case 1st (Art. HYDATID) in my Morbid Anatomy of the Gullet, &c.

slight degree of inflammation is excited. This is followed by adhesions. The Cyst containing the Hydatids is destroyed, by which the Hydatid escapes from its original situation.

There is a much greater disposition to the destruction of the Cysts which contain the Hydatid, and other containing parts, than when water is accumulated within the shut cavities.

Hydatids generated within the Liver, sometimes make their way into the Abdomen, and also upwards into the Thorax; and sometimes, though much more rarely, into the substance of the Lungs. The Hydatids also have got into the branches of the Trachea, and have been discharged by coughing.

In the same manner, Hydatids formed in the substance of the Kidneys, have worked their way out of the Pelvis of that organ, and have been discharged with the urine.

As Hydatids seldom prove fatal when they have found an outlet, and as there is a disposition in nature to discharge Hydatids from the body, an attempt should be made to assist, or to second the efforts of nature by art.

In the first place, a Tumour filled with Hydatids, situated in the extremities, or on the external surface of the body, may be with safety removed. Hydatids lodged within the cavities of the body, may also be extracted, providing the organ containing these has contracted an adhe-

sion with the containing parts, as was done with complete success. ‡

PLATER * has related the case of a young woman who had a Tumour in the right Hypochondrium, which was very painful, especially when she lay on the left side. It at length burst, and a large quantity of a serous fluid was discharged, besides a number of Hydatids; after which, the patient obtained a complete cure.

GUATANNI's † testimony is equally strong. He has related a case, in which the Parietes of the Abdomen over a Tumour in the region of the Liver became very thin; and the Tumour, in consequence of violent coughing, at length burst externally, and three hundred entire Hydatids, together with a quantity of a serous fluid, were discharged.

The opening remained fistulous for some time; but at length closed, and the patient recovered.

In the same manner, when Hydatids have been accumulated within the Uterus, these may be removed from it, as was done by Dr KILGOUR of Musselburgh, with perfect success.

A Lady was supposed to be in labour, and the Doctor was sent for to deliver her. The pains

‡ *Vid.* Case 7th, (Art. HYDATIDS), in my book upon the Morbid Anatomy of the Gullet, Stomach, &c.

* *Vid.* Obs. Select. MANTISSÆ, Obs. XVIII. p. 44.

† *Vid.* GUATANNI, de Extern. Aneurysmat. p. 119.

were at first very slight. After some time, a bleeding came on, which led the Doctor to examine the parts. He found the Os Tincæ a little dilated, and discovered that the Uterus was filled by Hydatids. The bleeding continuing, he was induced to endeavour to remove the Hydatids; which he accomplished, and brought away a bason full of these. The lady got well in a few days, and afterwards had four very healthy children. Thus, the cause of the Tumour is removed, which is not effected by opening a fixed Dropsical Cyst.

In many cases where there has existed a swelling of the belly, it has suddenly disappeared upon the discharge of Hydatids, by vomiting and purging. After a time, should another such Tumour begin to form; in these circumstances, though it is by no means certain that the Sac and the containing parts adhere to each other, if the Tumour be stationary, it may even, in some such cases, be advisable to puncture the Sac with a large Trocar, and empty it of some, or of the whole, of the Hydatids; or, if this cannot be accomplished, to inject into it the smoke, or the infusion of tobacco, or a very weak solution of camphor; or to give mercury, or some other substance which may kill the Hydatids, without being injurious to the patient. Prudence, however, suggests the propriety of endeavouring to ascertain, by experiments upon a-

nimals, the effects of those liquors which are to be used as injections.

Liver unnaturally Soft.

There are two species of disease in which the Liver attains a preternatural softness. In the former, the Liver is somewhat of a cream colour, not only on the surface, but also in substance; and is perfectly uniform on its surface.

The softness is not owing to putrefaction, for I have observed it a few hours after death.

This species I have most frequently found in children of a scrofulous habit.

I have also seen it in advanced life; and I lately saw it very strongly marked in a case in which the patient's husband declared, that the deceased had killed herself by dram drinking.

The Liver, from this disease, attains a considerable size, and often descends as far as the Navel; and ascends upwards, so as to compress the bowels of the Chest.

In the Section of the Liver, we do not observe the slightest appearance of the Acini of that organ. The Liver, in consequence of this disorder, acquires a sweetish smell.

Very little Bile is secreted in consequence of this derangement in the structure of the Liver: and the Gall-bladder, which is commonly remark-

ably small, contains generally but a small quantity of mucous fluid.

The bloodvessels of the Liver bear but a small proportion to the substance of the organ, and appear to be smaller than usual.

The Intestines are commonly filled by a white fæculent matter, such as is found within the bowels of those who die from Jaundice.

The glands connected with the Lymphatic System are generally much enlarged, and indurated; and sometimes we meet with a swelling of the Mesenteric Glands, or Tubercles in the Lungs.

In the other variety of disease, in which the Liver attains an unnatural softness, it does not become so large as in the former, and assumes a pink colour; and, when cut into, seems to be composed of a number of bodies of an oval figure, somewhat of the size of barleycorns, and which are rather of a paler colour than the rest of the Liver.

In this variety of diseased Liver, we sometimes meet with Hydatids within the substance of the Liver.

To the touch, the Liver feels very much like a portion of Lungs; and, like these, is very readily torn.

The bloodvessels do not acquire a præternatural size.

The Lymphatic Glands of the capsule of Glysson are generally enlarged and indurated.

This species of disease is not at all affected by mercury.

Rupture of the Liver.

The Liver has sometimes been ruptured in consequence of external violence. *

Worms of the Liver.

Worms have been said, by NIBELIUS, † and by LIEUTAUD, ‡ to be sometimes found within the human Liver. I have seen them frequently within the Gall Ducts of sheep, but never in the human body.

Of Biliary Calculi.

Biliary Calculi have been found in every part of the Biliary Ducts and Gall-Bladder; and are very various as to number, size, colour, consistence, specific gravity, structure, and chemical ingredients.

Biliary Calculi have been arranged into four classes.

The most common kind is very soft, of the co-

* On the effect of injuries of the Liver. Vid. MORGAGNI, Lit. 36. Art. 26.

† Vid. Nova Act. Physico-Med. Vol. V.

‡ Vid. Tom. I. p. 194.

lour of umber, and composed of layers loosely united to each other; and this kind is said by THENARD to consist of yellow matter of the Bile.

The second class are of a yellowish green colour, and are in form polygonal. *

We frequently meet with a great many such Calculi in the Gall-Bladder, of different sizes.

Such Calculi, when broken, are found to be composed of an external crust; and from their centre there are a number of shining radiated plates, which in a few places are intersected by the dark coloured brown substance above described.

The shining plates are composed of Adipocire.

Some of this class are so light as to swim upon the surface of water.

The third class comprehends such Biliary Calculi as are composed of white shining plates, and which DR BLACK, thirty years ago, informed my Father was similar to Spermaceti; and FOURCROY called this substance Adipocire, from its resemblance to fat, and wax.

Such Biliary Calculi have a greasy feel; are generally of an oval figure; rarely attain a large size; are very often found within the Gall-Bladder; and, when broken, are found to be composed of brilliant white shining plates, like *Mica*.

Such Calculi are soluble in oil of Turpentine

* *Vid.* Plate XXXII.

and heated alcohol; but as the alcohol cools, the matter is deposited in brilliant plates.

The fourth class comprehends such Biliary Calculi as are not soluble in alcohol or oil of turpentine; they do not emit flame, but become red.

There is a fifth, but very rare, kind of Biliary Calculi, which, as far as I know, has not been described: which is of a jet black colour; of a shining appearance, and seldom attains a large size; and is very irregular on the surface. I have never seen such Calculi but in the Ductus Communis Choledochus.

Biliary Calculi, of the size of an egg, have sometimes worked their way into the Colon, and have also been discharged by stool; or have worked their way through fistulous openings on the surface of the Abdomen.

I have described such a case;* and was so fortunate as to prevail upon my friend, Mr John Davy, to examine one of the Calculi which had been discharged.

" The substance you favoured me with, resembles Biliary Calculi as much in its chemical, as you observed it did in its physical, properties.

" From my experiments, made on a small scale, it appears to be insoluble in water; but soluble in the sulphuric, muriatic, and nitric acids, and in ammonia.

* Vid. Morbid Anatomy of the Gullet, Stomach, &c.

"The first effect of concentrated sulphuric acid was to change its light brown colour to a cochineal red. Notwithstanding, the solution of this substance in the acid, which readily takes place, without even the application of heat, is not red, but of an olive green colour; and it remains so even when diluted with water, no apparent alteration of any kind occurring.

"Nitric acid, like the sulphuric, reddened this substance; and the solution, which rapidly formed, and without any effervescence, being produced, was of a reddish brown colour. The addition of water to the solution occasioned the separation of a reddish white matter.

"The action of muriatic acid on it was not so decided, or nearly so powerful, as that of the two preceding acids. The acid retained its former colour; but that part of the substance which remained undissolved was nearly white.

"The ammoniacal solution was of a yellow colour.

"This substance melts when gently heated, and takes fire when exposed to a sufficiently high temperature; and burns with a dense yellow flame.

"Thirteen grains of it, burnt in a platina crucible, afforded only $\frac{3}{10}$ths of a grain of white earthy matter; which, as it reddened turmeric paper, and effervesced with nitric acid, appeared to contain carbonated alkali; and, as nitric acid entirely dissolved it, and the solution was rendered turbid by

ammonia, there seemed to be phosphat of lime present.

" Heated in a small bent glass tube, connected with a water pneumatic apparatus, only a few bubbles of gas were produced; there was no residue, but a total sublimation of the substance. The condensed product was not unlike petroleum; it had a brownish black colour, a bituminous smell, and a viscid consistence.

" These are all the experiments I have made on this interesting substance. Their results are so similar to those obtained from true Biliary Calculi, that there can be little doubt but this belongs to the same class of bodies; and, independent of its appearance, its slightly bitter taste confirms this conclusion."

Biliary Calculi have also been discharged through a fistulous opening, on the surface of the Abdomen, which communicated with an abscess of the Liver, or with an enlarged Gall-Bladder.

The Coats of the Gall-Bladder have been found thickened and hard; and the Gall-Bladder has been sometimes much contracted, and, according to some, obliterated.

The Biliary Ducts have been sometimes obliterated.

SECT. II.

OF THE ORGANIC DERANGEMENTS OF THE SPLEEN.

Inflammation of the Spleen.

Inflammation is sometimes limited to the investing membrane of this organ.

When the surface of Spleen has been inflamed, it very frequently adheres to the neighbouring parts; more especially to the Diaphragm, or to the large Sac of the Stomach.

The substance of the Spleen has been said to be sometimes very much inflamed; but I have never seen it in such a state.

The Spleen has been described as partaking of inflammation, which probably originated in the Lungs, and which affected the left lobe of that organ.

Sometimes the inflammation spreads to the Stomach, Colon, and Liver.

The inflammation sometimes leads to abscess; and, when that happens, there is generally a large quantity of pus, which is attended by a destruction of the substance of the Viscus, so that nothing remains but the outer peritoneal covering, which forms the Cyst of the abscess.

In the second volume of the Edinburgh Medical and Surgical Journal, there is a well marked case of this disease described by DR DRAKE.

The patient, a lady advanced in life, had very acute pain in her left side, combined with frequent sickness.

Towards the conclusion of this patient's sufferings, there was an evident tumour, with a distinct fluctuation, which reached from the Cartilago Ensiformis to the Navel. The tumour was circular and prominent. It was tapped by Mr BURNS, and a large quantity of pus was discharged.

It merits mention, that in this case the bulk of the Spleen affected the Stomach so much, that nothing could be retained; and sometimes the purulent matter of the Abscess, bursting into the Abdomen, proves a cause of sudden death.

The Spleen is sometimes, though very rarely, the seat of the scrofulous tubercles.

Induration of the Spleen is the most frequent disease of that organ.

Sometimes the Spleen is much enlarged, and acquires a uniform hardness; sometimes, like the Liver, it is tuberculated.

PORTAL * has remarked, that girls who do not menstruate regularly, are subject to swelling and enlargement of the Spleen: upon the menstruation being re-established, the Spleen regains its former size.

Spleen very Small.

The Spleen has often been found of a very

* Anat. Med. Tom. 5. p. 339.

small size. This may be the consequence of suppuration. The Capsule of the Spleen has sometimes been reduced to the state of Cartilage.

Spleen Ossified.

Haller and Lieutaud have made mention of the Ossification of the Spleen.

Stony Concretions of the Spleen.

Concretions have been found in this organ sometimes, though very rarely. *

Spleen of a Preternatural Softness.

The Spleen has been described as being gorged by black blood, and also of a preternatural softness, in conseqence of scurvy, and intermittent fevers of different kinds, which Lieutaud has observed to be sometimes the effect of Jaundice.

Ruptured Spleen.

The Spleen has sometimes been ruptured, in consequence of an over-exertion. I met with such a case. The patient suffered at the moment the most excruciating pain in the left side, which gradually abated, but did not leave him. He

* *Vid.* Lieutaud, tom. I. p. 231.

died, three years thereafter, from Pneumonia. The Spleen, after death, was found in an enlarged state.

SECT. III.

OF THE ORGANIC DERANGEMENTS OF THE PANCREAS.

The Pancreas is subject to inflammation and all its consequences.

The Pancreas has sometimes been found in a state of suppuration, by which the greater part of the gland has sometimes been destroyed.

According to LIEUTAUD, this disease is often the effect of the suppression of some of the usual discharges; as of the Mucus, of Diarrhœa, of Hemorrhoids.

Gangrene of the Pancreas.

This disease is mentioned by STORK, HALLER, RIOLAN, LIEUTAUD.

In such circumstances, the Pancreas has been described as being of a deep violet colour, preternaturally soft, and as containing a black fetid liquor.

Scirrhus of the Pancreas.

This organ is sometimes reduced to a scirrhous state.

The Scirrhous Pancreas cannot generally be perceived by an examination by the hand, except where it is very much enlarged, and in persons who are much emaciated.

Calculi in the Pancreas,

Are by no means so frequent as in the biliary or urinary canals. Dr BAILLIE says he had seen only one instance of this disease; and Dr CAMPER showed one to my Father. *

These Calculi seem to be similar to the Calculi found in the ducts of the other salivary glands, being always of a white colour.

PORTAL † relates the history of a case, in which he found a dozen of such concretions, of various sizes, some of which were as large as a hazel nut; and the Pancreatic Duct was so much enlarged, as readily to receive a very large quill.

Upon reducing some of these Calculi into powder, and throwing them into boiling water, he has observed that they were soluble in that fluid, and had an insipid taste. In that instance, the Pancreas was much enlarged, and compressed the Aorta, which was in an aneurismal state, against the Spine.

* *Vid.* Morbid Anat. p. 226. 2d edit.
† *Vid.* Anat. Medicale, Tom. V.

Sect. IV.

OF THE ORGANIC DERANGEMENTS OF THE OMENTA.

The Omentum is subject to the same organic derangements as the subcutaneous fat.

It is frequently inflamed, and contracts adhesions with the neighbouring parts; and, in the case of a Tumour of the Stomach and Intestines, it generally adheres to it.

Steatoms are sometimes connected with the Omentum; so that it somewhat resembles a bunch of grapes.

Scirrhus of the Omentum, also, has been described. Hydatids are sometimes connected to the Omentum; and water has been collected within the Sac of the Omentum.

The Omentum has frequently been found gangrenous, in cases of strangulated Herniæ.

EXPLANATION OF PLATE XXXII.

In this Engraving, six Biliary Calculi, of the form of polygons, are represented, and nearly of the natural colour.

It may be proper to add, that we sometimes meet with a great number of such Biliary Calculi within the Gall-Bladder, of different sizes, though nearly of the same figure.

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PART VII.

CHAPTER I.

OF THE LACTEAL VESSELS THROUGH WHICH THE NUTRITIOUS PART OF OUR FOOD PASSES INTO THE BLOOD.

THE vessels through which the nutritious part of our food passes into the blood, which form a part of the Lymphatic or Absorbent System, have been called, on account of the resemblance of their contents to milk, *Lacteal Vessels.*

SECT. I.

OF THE LACTEAL VESSELS.

THE Lacteal Vessels are of a small size; have very tough, though thin Coats, through which the colour of their contents is perceptible; have a jointed appearance; are more numerous than the veins which convey the red part of the blood;

and freely and repeatedly communicate with each other, and with certain glands, which have been named *Lacteal Glands*, or, from their situation, *Mesenteric Glands.*

There are small vessels in other parts of the body, which are similar to the Lacteal Vessels as to structure and office; and these have been named *Lymphatic Vessels*, as they are filled by Lymph.

The Lymphatic Vessels are proper to every part of the body; and though those of the human Brain have not been seen or represented by any author excepting MASCAGNI, still, there is no reason to doubt of their existence.

In every part of the absorbent system, there are Valves; but these are not equally numerous; for, in some of the vessels, there are four or five pairs of Valves in the space of an inch; but, in others, not above one pair in the same space.

These Valves perform their office with very great accuracy, even after death. They support the pressure of a column of quicksilver, without giving way, and prevent its retrograde course.

The greater number of the Lymphatic Vessels follow the same course as the Arteries and Veins, but are more numerous than these; and they pass through Glands, which, in all respects, resemble the Lacteal Glands.

Sect. II.

OF THE SITUATION AND STRUCTURE OF THE LACTEAL AND LYMPHATIC GLANDS.

The Lacteal and Lymphatic Glands are found singly, or disposed in clusters; and are much more numerous in some, than in other parts of the body. They abound in the Mesentery, Axilla, sides of the Neck, in the Groin, and at the great division of the Aorta into the Iliacæ Communes.

The Glands connected with this system are various in colour and size in different places, and also at different periods of life, being much larger in early than advanced life; and, generally speaking, are of an oval or rounded figure.

These Glands are connected to the neighbouring parts by cellular substance, and are covered by a membrane of considerable density, upon which a number of bloodvessels are distributed.

It has not yet been determined, by dissection, whether or not there are Nerves which enter into the substance of the Lymphatic Glands; though many of these lye in the immediate vicinity of the large trunks of the Nerves.

There are some of the Lymphatic Vessels which pass through several glands; but others do not enter into one of these glands: hence a poison may enter the blood without creating a Bubo in any part of the body.

The Lymphatic Vessels which enter the Glands have been called *the Lymphatics* of the first order, or *the Vasa Inferentia*; and those which come out from the Glands, *the vessels of the second order*, or *Vasa Efferentia*.

Anatomists have differed in opinion as to the structure of the Lymphatic Glands. My Father has represented these Glands as being chiefly *composed of a plexus of very minute vessels*; and states, that the smaller branches of the Vasa Inferentia join with many of those of the Vasa Efferentia; whereas other authors have affirmed, that there are a *number of small cells* interposed between the smaller ramifications of the Vasa Inferentia and Vasa Efferentia.

Sect. III.

OF THE COURSE OF THE LACTEAL VESSELS.

These vessels take their rise from the Villi of the Intestines by short radiated branches; pass for some way under the muscular coat; then perforate it, and join another set of Lacteal Vessels; and form a plexus of vessels, which is placed between the layers of the Mesentery, and follows nearly the same course as the bloodvessels.

The Lacteal Vessels of the smaller Intestines are more numerous than those of the larger; and those of the Intestinum Ileum are more numerous than those of the Jejunum.

The Lacteal Vessels, in their course along the Mesentery, pass through two or three Lacteal Glands; and at length the Lacteal Vessels unite, and form two or three trunks, which accompany the Superior Mesenteric Artery, till they reach the right side of the Aorta, where they pass into the origin of the Thoracic Duct, which passes upwards along the Spine, and pours its contents into the blood, near to the junction of the Internal Jugular and Subclavian Veins.

SECT. IV.

OF THE CAUSES AND MANNER OF ABSORPTION.

THE contents of the Lacteal and Lymphatic Vessels cannot be propelled by the Vis a Tergo; as the Lymphatic is unconnected with the Vascular System; nor by a muscular contraction of the coats of the Intestines.

The Lymph enters the Lymphatics where muscular pressure can be of no avail, as within the bones: the fluid therefore enters the Lymphatic Vessels by capillary attraction.

But capillary attraction only moves the fluid a given way within the vessel.

After a certain time the liquor stops, unless the contents of the Lymphatics be propelled forwards,

by means of the muscular contraction of the vessels themselves.

The contraction probably begins at the very orifice of the Lymphatic Vessels, and is continued along the vessel, in so perfect a manner, as to propel the contents of the vessel : And, in some animals, as fishes, valves are wanting.

The Valves no doubt assist in determining the contents of the Lacteal and Lymphatic Vessels, towards the heart; as also the contraction of the neighbouring muscles, and even the pulsation of neighbouring arteries.

The muscular contraction of the Lymphatic Vessels may be distinctly seen in the Sea Egg, or Star fish, where it is very perfect: in these animals, there are no Valves to assist in determining the contents of these vessels towards the Heart.

By means of this muscular contractile power, the Lymphatic Vessels adapt themselves to the different substances; opening, and receiving those which are of a mild nature, and contracting upon those which are of an irritating nature; thus the colouring principle in wine, is much more minute than the globules of milk, notwithstanding which, it is not taken up by the Lacteal Vessels.

The muscular power lessening the diameter of the Lymphatic Vessel, increases the capillary attraction; for the smaller the diameter of a tube, the higher its contents rise.

The *Eschinus Marinus*, when it endeavours to seize any substance, enlarges the extremity of its

tubes; but at other times, it contracts them. It can elongate the Lymphatic Vessels, and thus increase or lessen the diameter of the Absorbing Vessel.

Our absorbents probably also vary their calibre, according to the matter to be absorbed.

It is probable that different parts of the same Lymphatic possess very different degrees of irritability.

These vessels are probably more irritable at their mouths than elsewhere; which irritability is propagated along the Lymphatic Vessel by the stimulus of the Chyle.

This is by no means a solitary case; for particular parts of membranes are endowed with very different degrees of irritability: thus the Pharynx, Glottis, and Larynx, are lined by the same membrane; but that part of the membrane which lines the Larynx, is much more exquisitely sensible than that of the Pharynx; for if a drop of water, or even of warm saliva, gets into the Glottis, even distant muscles are thrown into convulsions, and a fit of coughing is excited.

Farther, at different periods of life the absorbent Vessels possess different degrees of irritability.

Absorption goes on more quickly during very early life than in old age; and it has even been affirmed by some authors, that the Lymphatic Vessels of young persons continue to perform absorption for a short time after death.

SECT. V.

OF THE UTILITY OF A KNOWLEDGE OF THE COURSE AND FUNCTIONS OF THE LYMPHATIC SYSTEM.

THE Lacteal and Lymphatic Vessels assist in carrying on some of the most important functions of the animal economy.

1. Through the Lacteal Vessels, the nutritious part of our food is carried into the blood.

2. By means of the Lymphatic Vessels, the Bile, Semen, and other secreted fluids, attain their proper consistence, and are rendered more fit for their several purposes.

3. The Lymphatic Vessels prevent the unnatural stagnation and accumulation of fluids within the shut cavities.

4. The Lymphatic Vessels indirectly contribute to the growth of the body. By these vessels, the original matter is taken up, in order to make room for new ingredients which are about to be deposited; and this takes place, not only during the formation of the softer parts, but also during the formation of the Skeleton.

5. By a knowledge of the Lymphatic System, we may gain a knowledge of the source and manner in which many diseases are propagated from one part of the body to another.

A poison which has entered one part of the Lymphatic System, is rapidly conveyed into the blood, producing, in its course, a swelling of the Lymphatic Glands, between the place where it was received and the heart, which points out the source and manner in which diseases are propagated.

A Blister, for example, applied to the neck, does not occasion a swelling of the Lymphatic Glands immediately above it: those glands only are affected which are situated between it and the Heart; and the course of the Lymphatic Vessels may readily be traced, as the Coats have frequently been considerably thickened, in consequence of the stimulus.

A venereal infection, in the same manner, creates a swelling of the upper cluster of the Inguinal Glands, though the inferior cluster be equally near to the place of the infection, and receives Nerves and Bloodvessels from the same sources; whereas a confirmed Pox, connected with Nodes or Ulceration on the Tibia, occasions a swelling of the lower cluster of Inguinal Glands.

If a nurse, or the child she suckles, is afflicted by the Venereal disease, the one readily communicates the disease to the other.

It is frequently of moment to discover which has been originally in fault. The Lymphatic Glands which are affected determine the point.

If the Axillary Glands are affected, the disease has probably originated from the child; but, if

the child has imbibed the poison from its nurse, the Lymphatic Glands around the mouth become, in the first place, diseased.

It seems probable, that the Venereal poison, in some cases, enters at the orifices of the Lymphatic Vessels; for it sometimes occasions a Bubo, without a previous Gonorrhœa or Chancre.

It may not be improper to add, that it is possible that the blood may be tainted by the Venereal poison, though there is no swelling in any of the Glands of the Lymphatic System; as some of the Lymphatic Vessels do not lead to any of the Lymphatic Glands.

The Lymphatic Glands are sometimes swollen, from the *Measles*, *Scarlatina*, *Plague*, *Cancer;* and those tumours in the Lymphatic Glands are of the same nature with those diseases which gave them birth.

Hence, if a Surgeon extirpates a cancerous mamma, he must also take out the enlarged and diseased Axillary Lymphatic Glands; because the Axillary Glands are as much diseased as the Mamma, and may generate more poison.

Besides, these diseased glands pour the poison directly into the blood. Hence, a strong argument for the identity of diseases may be deduced from the Lymphatic Vessels and Lymphatic Glands being affected in the same manner by diseases.

The Lymphatic Glands assume the same morbid appearance from Chancre and Gonorrhœa;

and hence, these disorders are probably produced by the same kind of poison.

6. From the state of the Lymphatic Glands in the neighbourhood of a diseased part, an opinion may be formed, whether the Tumour is in an indolent state, or whether acrid matter has been generated within it.

Thus, take the case of a woman labouring under a Scirrhus of the Breast. If the Lymphatic Glands of the Axilla are swollen, there is reason to apprehend that the Scirrhus has degenerated into a Cancer; and the swelling of the whole arm is an index of the advanced state of the Cancer. This circumstance is also a proof, *that the Veins conveying red blood do not perform absorption;* because, though the enlarged and diseased Axillary Lymphatic Glands press upon the Veins conveying red blood, yet the Cephalic Vein, which passes between the Pectoral and Deltoid muscles, is not, cannot be in the smallest degree compressed.

7. The knowledge of the course of the Lymphatic System may also suggest the most efficacious method of administering medicines, with the view to mitigate the acrimony of several poisons, and thus to remove the danger of such disorders.

For example, the Lues Venerea, which is received and propagated by the Lymphatic Vessels, may be more effectually cured by rubbing in mercury, so that it shall pass through the Lymphatic

Vessels, and Lymphatic Glands, than when given by the mouth.

Thus, also, the Small-pox has been disarmed of its virulence by inoculation. The variolous poison becomes less acrid during its passage through the Lymphatic Vessels, and Lymphatic Glands, than when the infection has been received in the natural way; for the lungs are then primarily affected.

The above circumstances led my Father, IN HIS TREATISE ON THE LYMPHATIC SYSTEM, to propose *Inoculation* of the Measles, in order to diminish the severity of a disease, which, though in itself rarely fatal, is extremely apt to induce diseases of the Lungs.

DR FRANCIS HOME, about an year thereafter, endeavoured to communicate the *Measles* to children, by dipping lint in the blood of a patient who had the disease. The experiment was not attended with a favourable result. His success might probably have been greater, if the inoculation had been practised, as in the Small-pox.

That my reader may gain a still more extensive view of this very important subject, I have subjoined those conclusions which my Father has annexed to his Treatise † on the Lymphatic System.

† *Vid.* the 2d Edition of his Treatise de Venis Lymphaticis Valvulosis. Edinburgi, 1770, p. 104–119.

" (1.) Quum in vasis valvulis stipatis humorum cursus mechanice promoveri possit, doctrina hæc commodis, ab exercitatione et frictione corporis nostri, in multis morbis, sperandis, novam quasi lucem affundit.

" (2.) Quum ex dictis constet humores sorptos, non in venas rubras proximas, sed ad cor dextrum recta via ferri; inde firmo minus talo niti videntur theoriæ plures, quas virorum maxime celebrium, BOERHAAVII, HALLERI, aliorumque ingenium ita ornavit, ut ubique in artem pro veris admissæ fuerint: Quales sunt quas de bile ab intestinis, et adipe ab omento, ad venam portarum; vel de spiritu quodam aërio vivificante, ad cor sinistrum rapto, finxerunt.

" (3.) Quum vasa lymphatica valvulosa in cor dextrum desinant, materia acris, a quocunque corporis loco resorpta, pulmones, post cor, præ reliquis organis, salutat; atque majori, quam in ullo alio organo, copia, quoniam omnis cum sanguine per eos transit. Hinc organi cujuscunque in suppurationem soluti contagium, promptius cum iis, quam cum ullo alio organo, communicatur.

" Atque, si quando materia purulenta in ipsis pulmonibus gignitur, hujus particulæ resorptæ statim a corde dextro in ipsos recurrunt omnes, ut inde sanationis spes quodammodo minuatúr.

" (4.) Chirurgi quidam, multum in praxi versati, gonorrhœam virulentam et luem veneream, quæ præter genitalia omnes fere corporis partes adficit, natura sua prorsus discrepare, nec illam

in hanc mutari unquam, adserere non dubitarunt. Disputarunt etiam, an bubo ad hanc, vel ad illam potius, referri debeat. Ex supra dictis vero adparuit, bubonem esse materiæ contagiosæ per venas lymphaticas intus susceptæ et in glandulis conglobatis obstructæ effectum. Ex quo igitur demonstratur nexus inter gonorrhœam virulentam et luem jam invalescentem; quum bubo sit quasi medium inter hanc et illam. Si enim omnem materiam morbosam in glandula obstructa hærere, et suppuratione superveniente ejici, supponamus; quod tamen rarissime accidere, et lymphaticorum decursus suadet, et experientia tristis confirmat; æger a lue tutus evadet. Si vero non omnis hæreat; vel si bubo discutiatur, i. e. si venenum procedat, et sursum per venas lymphaticas ductumque thoracïcum in sanguinem progrediatur; cum reliquo corpore communicatur malum, et ægrotus lue venerea, vulgo dicta, laborat. Mirum quidem videtur, res experientia quotidiana comprobatas in dubium revocari.

"(5.) Lues venerea, uti vidimus, per venas lymphaticas sæpe in corpus sibi ingressum quærit; et in glandulis conglobatis, quas salutat, haud raro hæret. Mercurius, nec quatenus sanguinis velocitatem et vim incitet, nec quatenus particulas morbosas ejiciat, sed ratione quasi specifica, si practicis nonnullis fides adhiberi debet, huic morbo mederi videtur. Hinc forte haud prorsus inutile esset, mercurium et mercurialia loco primario adfecto admovere; quæ, iisdem viis insistendo,

veneni vires fortasse lenirent vel delerent, antequam sanguinem ingrediretur.

"(6.) Si quando glandulæ lymphaticæ, cor atque scirrhum, aliumve tumorem, interjectæ, indurescere atque attolli incipiunt, scirrhum in cancrum occultum mutari, aliosque tumores in humorem acrem fundi cœpisse, discimus. De quibus vero expertissimos ac recentissimos medicos practicos quotidie, in ægrorum damnum, hallucinari, observare licet. Sic egregius STORCK, * aliique multi, cancrum occultum pro scirrho passim habent.

"(7.) Immo scirrhum in cancrum mutatum scire licet, quamvis glandulæ lymphaticæ, in quas vasa ejus lymphatica terminantur, situ suo, tactum fugiunt; si forte membra alia, quorum lymphatica vasa in easdem glandulas desinunt, œdema occupat. †

"(8.) Porro a glandularum lymphaticarum, quæ induruerint, situ, judicare datur, an contagium systema lymphaticum solum affecerit, atque nondum cum sanguinis rivo commixtum fuerit; an potius, sanguini prius commixtum, ab illo iterum ejiciatur.

"Sic si venerea lues, coitu concepta, glandulas inguinis superiores mulctaverit, recentem esse pronunciare licet; si vero inferiores vel remotas affecerit, luem confirmatam esse constat.

"(9.) Cum itaque scirrho-cancrum exscindere

* In libello de Cicuta.

† Vid. supra, a pag. 92. ad 97.

decretum sit, glandulas lymphaticas, quæ induruerint, simul auferendi necessitas chirurgis patere potest.

"(10.) Patet etiam quantum se ægrosque spe inani lactent chirurgi, qui, post mammam, scirrhocancrosam exscissam, felix inde omen ducunt quod axillares glandulæ, quæ prius induruerant, quasque non abstulerint, nunc detumescere incipiunt: Quum glandularum harum solutio contagium immedicabile cum sanguine nunquam non commisceat.

"(11.) Pensitandum nunc venit, quantum morbos immedicabiles, dum corpus nostrum per systema lymphaticum subingrediuntur, priusquam sanguini commisceantur, distinguere; atque, horum cursum intercipiendo, effectus deleterios prævenire, valeamus.

"Apud auctores, qui de peste egerunt, frequens occurrit observatio, bubones, nimirum, pestiferos suppuratione solutos, valde salutares esse. Si itaque prima infectionis in ægrotante nota fuerit hujusmodi tumoris inexspectata eruptio; quod quidem et medici Galli, et alii etiam, spectatæ fidei auctores, nobis adsertum reliquerunt; * unde verisimile videatur ab absorptione materiæ pestiferæ per venas lymphaticas hunc provenire: Nonne, hoc in casu, excisionem harum glandularum eximii usus fore, spes est? Radicitus enim tollit materiam pestiferam in glandulis hærentem; obstat, ne plus ejusdem, hisce saltem viis, sangui-

* Mead de natura et origine pestis.

ni immisceatur; et fonticulum, vel ulcus, efficit, per quod corpus a particulis noxiis, jam forte in sanguinem abreptis, liberari potest. *

" Dum de atrocissimo hoc morbo dico, notare utile sit, eum sæpius glandulas faciei, colli, et extremitatis superioris, occupare, quam inguinum et extremitatis inferioris ; ex hoc forte, quod illæ aëri externo plus exponuntur. Hinc corpus bene tectum habere, ad pestem avertendam, quiddam forte valebit.

" Corporis porro inunctionem, quæ venarum lymphaticarum ostia oppilat, et luis venereæ, et pestis forte etiam, contagium, quatenus per cutim externam hæc suscipitur, quodam modo depulsuram, non sine causa conjicere licet.

" (12.) Ponamus, quod chirurgo, inter cancrum exscindendum, infelici adeo esse contigerit, ut, vulnerato digito suo, virus subingressum tumorem in glandula quadam axillari moverit : Nonnæ glandulæ hujus exscissio, cum inustione vulnerati digiti, ad dirum hoc contagium præveniendum, illi commendanda est ?

" (13.) Plerique medici bubonis suppurationem, molestam quamvis semper ac sæpe tædio plenam, potius quam resolutionem ejusdem, mo-

* Mead, de curatione pestis, hæc habet : " Ubi pestis minus sævo morsu lacessit, in molliores decumbit glandulas, quæ ad corporis superficiem prominent ; quales sunt inguinales, axillares, &c. Si convalescere datur ægrotanti, tumores ii, uti in variolis, legitimam nanciscuntur suppurationem, morboque naturam hac via exonerant. "

fiuntur. Hanc enim luis venereæ periculum gravius ægro intentare, credunt.

" Nuper vero chirurgi quidam, ut minori cum tædio et ægri incommodo sanitatem restituerent, bubones radicitùs exscindere tentarunt. Sed quantumvis operatio hæc caute instituatur, propter arterias venasque vicinas, discrimine plena est ; nec tantam medelam morbus facile medicabilis postulat.

" (14.) Variolarum insitio, contagio naturaliter contracto, præter alia multa, in eo præstat, quod in hoc venenum, in aëre fluctuans, in primas vias, inque pulmones, adtrahitur ; in quibus latitare et inflammationes et obstructiones valde periculosas excitare valet : In insitione vero arte effecta, vitium organa minoris momenti, et subcutanea, tantummodo percurrit, antequam sanguini immisceatur. Hinc raro virus organa nobiliora adoritur ; sed cutem, quam hic morbus, plus quam alias partes, adfectare videtur, petit.

" (15.) Quam feliciter cesserit variolarum insitio, neminem latet. Morbillorum vero insitionem multo utiliorem et feliciorem fore, omnino persuasum habeo. Nimis enim notum est, quam proclivis sit hic morbus ad pulmones infestandos, quantamque exinde stragem edat. Hoc, primo contagio in aëre volitanti, et in pulmonum cellulas inter inspirandum hausto, iis tenaciter adhærenti, inflammanti, tussim hinc vel naturæ conatum ad materiam noxiam depellendam, concitanti, magna ex parte deberi videtur. Si vero per insitionem

arte factam inducerentur morbilli, ab inflammatione pulmones magis vacuos fore, et cutim fere tantum morbum invasurum esse, verisimillimum fit. Hoc si ita contingeret, quantum commodi et utilitatis generi humano adferret? Incommodi aut damni nihil adferre potest experimentum. Insitionem fieri posse, probabile est, si tantum pustulæ, vel maculæ, maturæ gossypio perfricentur, et hoc dein, vel recens, vel vitro accurate obturato immissum et conservatum, vulnusculo indatur, eadem prorsus ratione ac materia variolosa.

"(16.) Scrophula glandulas lymphaticas præsertim occupat. Hinc, medicamenta externa deobstruentia hoc in morbo in primis profutura, censendum est: Quum, per venarum lymphaticarum resorptionem, immutata fere ad ipsius sedem pertingere possint; atque exinde solida aptius stimulare, materiam morbosam efficacius corrigere et mutare, valeant, quam remedia interna vulgo adhibita, quæ, per longas vasorum ambages, debilitata et permutata, ad loca adfecta tandem feruntur. Hinc forte, ubi colli glandulæ plectuntur, vesicantium, quæ capiti admota sunt, commoda.

"(17.) In omnibus denique glandularum conglobatarum adfectibus, multo sæpius, quam solet, in usum revocanda sunt remedia externa."

[illegible]

PART VIII.

CHAPTER I.

OF THE ORGANIC DERANGEMENTS OF THE LYMPHATIC SYSTEM.

THE Coats of the Lymphatic Vessels are similar to the serous membranes, and subject to similar organic derangements, Inflammation, Adhesion, and Ossification. The Lymphatic Vessels sometimes are much enlarged, or become varicose, and sometimes are ruptured. *

The Lymphatic Glands are much exposed to disease. They are frequently enlarged from Lues Venerea, Cancer, Scirrhus and Scrofula, by which they are filled by a matter like cheese; and sometimes these glands are filled by bone.

SCHREB has described a Calculus, which he found within the Thoracic Duct.

In a case of a Diabetes, I found the Absorbent System in a very peculiar state.

* Mr WHITE of Manchester has imputed the Phlegmasia dolens to a rupture of the Lymphatic Vessels.

The Iliac, Lumbar, Mesenteric, Cæliac, and Bronchial Glands, were much enlarged. Their size varied from that of a dried pea to that of a walnut: one of the bronchial glands was about the size of a small hen's egg. The enlarged Mesenteric Glands were of an oval figure, much flattened, and of a yellowish colour. There were a great many enlarged glands in that part of the Mesocolon attached to the Colon; but I found no appearance of Glands upon the Coats of the small or large Intestines. Those Glands nearest the Intestines were of the smallest size. Those near to, or at what is called by Anatomists the Root of the Mesentery, were the largest.

The natural texture of many of these Glands was in a great measure destroyed. No vessels could be seen in them, though some of them contained matter more or less fluid. The Lumbar Glands were filled with a matter like the fibrine of the blood. The Bronchial Glands were to the touch hard, and filled by a calcareous matter of a dirty white colour, and very like to chalk and water.

Although almost all the Glands connected with the Absorbent System were considerably enlarged, yet none of the Lacteals or Absorbents seemed to be dilated; nor were any of the Lacteal Vessels filled with Chyle.

The arborescent course of the Absorbents of the Liver could be distinctly traced, as they were filled with Lymph. Unfortunately, in the remo-

val of the Thoracic and Abdominal Viscera, the Thoracic Duct was destroyed.

Authors on the Absorbent Vessels.

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PART IX.

CHAPTER I.

GENERAL DESCRIPTION OF THE PARIETES, AND CONTENTS OF THE THORAX.

SECT. I.

To expose the Muscles covering the fore part of the Thorax, an incision should be made through the skin in the direction of the Breast-bone, and extended obliquely outwards along each of the Clavicles. Upon raising up the skin, cellular substance, fat, Mammæ; the *Greater Pectoral Muscles*, covered by a thin tendinous Aponeurosis, and at their upper part by the thin muscle called Platysma Myoides, come into view.

The fibres of the *Pectoral Muscle*, which arise from the Cartilages of the fifth and sixth Ribs and Clavicle, converge, and form a strong tendon, which is fixed into the Os Humeri; and on the fore part of the Pectoral Muscle, there are several small branches of the Internal Mammary

Arteries, which come through the interstices between the Ribs. On the lower edge of the Pectoral Muscle, the extremities of the Long Thoracic Arteries are distributed.

Under the Greater, the *Lesser Pectoral Muscle* is situated.

The sides of the Thorax are covered by the Serrated muscle, called *Serratus Anticus Major.*

Upon removing the *Serratus Anticus Major*, the oblique muscular fibres between the Ribs, called *Intercostal Muscles*, come into view; under which there is a membrane, of an opaque white colour, called Pleura; but, upon the air being admitted into the cavity of the Chest, that membrane seems transparent, the Lungs which were before in contact with it having collapsed.

Upon the muscles of the Thorax being removed, the conical figure of the Thorax becomes evident, the seeming breadth of the upper part of it being occasioned by the prominence of the shoulders.

The form of the Ribs, and the manner in which these are connected to the Breast-bone, have been explained in the preceding volume.

When the muscles of the Thorax have been removed, the student should attend to the oblique direction of the Ribs in respect to the Spine; and that, upon the ribs being raised, their Cartilages are twisted; hence the force is removed by which the Ribs were elevated; and they regain their

original situation, in consequence of the elastic reaction of their Cartilages.

Measurements of the Capacity of the Thorax.

The following are the measurements of the capacity of the Thorax, taken at an average from a number of bodies.

	Inches.
From the top to the bottom of the Breast-bone - - - - - -	6
From the top to the bottom of the Thorax, at the ſides of the Dorsal Vertebræ -	10
From the top to the bottom of the Pleura, at the outer side of the Pleura -	$12\frac{1}{2}$
The breadth of the cavity of the Thorax at the top of the Sternum - - -	4
The breadth of the Thorax behind the Cartilago Ensiformis - - - -	10

The Depth of the Thorax, and Distance from the Fore to the Back part of it.

From the upper end of the Sternum to the Dorsal Vertebræ - - -	3
From the under end of the Sternum to the Dorsal Vertebræ - - -	$6\frac{1}{2}$
From the anterior extremity of the eighth Rib to the deepest part behind it -	$7\frac{1}{2}$

Of the Female Mammæ.

The Mammæ, or Breasts, are of a hemispherical shape, and adhere to the anterior part of the Greater Pectoral Muscle, by means of cellular substance.

The breasts of the male are termed Mamillæ.

The ſize of the Breasts is very various at different periods of life. At birth they are large, and equal in size in both sexes; and a small quantity of a mucous fluid may then be squeezed out of them in either sex.

A short time before, or about the period of Puberty, they grow rapidly in the female.

At the approach of the Menses, the Breasts enlarge; and, at the cessation of the Menses, shrink.

The Mammæ attain a large size towards the latter months of utero-gestation; and, from their weight, become pendulous while a woman is a nurse; the cellular substance uniting the Gland to the Pectoral Muscle, being much elongated. The Mammæ of some savage nations, as the Hottentots, are frequently so long, that the mother can suckle her child whilst she carries it on her back.

The Mammæ are composed of glandular follicles, lactiferous ducts, fat, bloodvessels, nerves, and lymphatic vessels.

The Mamma is surrounded by a dark-coloured line, called Areola; upon the surface of which, there are the orifices of glands which secrete a mucous fluid, in order to prevent excoriation.

From the glandular parts of the Mammæ, the smaller lactiferous tubes arise, which are united into twelve or sixteen larger tubes, most of which open near to the apex of the conical-shaped projection of the Mamma, called its Papilla.

In the Papilla, which is very elastic, the lactiferous tubes are coiled up within cellular substance, in such a manner, that the milk does not flow through them until they are extended.

The Mammæ are largely supplied with blood from the External and Internal Mammary Arteries.

The Nerves of the Mamma are derived from the Axillary Plexus.

By the Breasts, the milk is secreted which is intended for the nourishment of the child for some time after birth.

This secretion begins a little before delivery; and the milk continues to flow for many months, if the woman suckles her child. There is much difference as to the quantity of the milk which is secreted; and even in the same woman in different pregnancies.

The child, by means of its Lips, grasps the Nipple, which excludes the external air; it then

acts with its Tongue, as by the piston of an exhausting syringe: thus the Papilla is stretched; the lactiferous ducts within it are stretched out; and the milk, being forced from the breast by the pressure of the atmosphere, flows into the child's mouth.

The milk of different animals is different.

The chemists have turned their attention chiefly to the milk of the cow, which is composed of the following ingredients.

Water.
Oil.
Curd.
Extractive.
Sugar of milk.
Acetic acid.
Muriate of Soda.
Muriate of Potash.
Sulphate of Potash.
Phosphate of Lime.
Phosphate of Magnesia. And
Phosphate of Iron.

Woman's milk differs from that of the cow: *First*, in containing less curd; *second*, its oil is so intimately combined with its curd, that it does not yield butter; *third*, it contains rather more sugar of milk.

Parmentier and Deyeux * ascertained that

* Journal de Phys. XXXVIII. p. 422.

the quantity of curd in woman's milk increases in proportion to the time after delivery.

SECT. II.

OF THE CONTENTS OF THE THORAX.

THE contents of the Thorax may be exposed by dividing the Cartilages connecting the Ribs to the Breast-bone on each side, (by which the Sterno-Costales muscles are brought into view, extending between the middle of the Breast-bone and the third, fourth, and fifth ribs), and then, by raising the Breast-bone, having previously cut the connexion between it and the Diaphragm.

While raising the Sternum, the two layers of Pleura, which form the Mediastinum Anterius, are distinctly seen: Also the triangular cavity between them, opposite to the upper part of the Breast-bone, within which the Thymus Gland, enveloped in a small quantity of fat and cellular substance, is situated.

The cavity of the Thorax being thus exposed, it may be observed to be divided unequally by the Mediastinum Anterius, which inclines to the left side; and hence the right side, or right Pleura, is more capacious than the left.

Upon the air being admitted into the Chest, the Lungs, which were in contact with their Parietes, immediately collapse; and, from having

collapsed in an equable manner, exhibit an exact miniature of the form of the Chest: and that part of the Lungs which rests upon the convex Diaphragm, is concave. On the left side, between the left Lungs, the Capsule of the Heart is placed; which is fixed not only to the Anterior Mediastinum, but also to the Lungs, and to the middle tendinous part of the Diaphragm, by a serous membrane called the Pleura.

The containing and contained bowels are connected to each other as follows—The Sternum, Ribs, and Intercostal muscles are lined by the Pleura, which being reflected from the Breastbone, forms one of the layers of the Anterior Mediastinum; from which, on the left side of the body, it is extended over the Heart and Lungs; and from the Lungs it is reflected upon the Vertebræ of the Back to the Ribs.

The Pleura of the opposite side follows a similar course; and a triangular space intervenes between the layers of the Pleura, where they are reflected from the Lungs to the Dorsal Vertebræ, forming what has been named the Posterior Mediastinum.

From the preceding description of the course of the Pleura, it follows, 1*st*, That the Heart and Lungs are so situated, and so connected, that the contractions of the Heart cannot interfere with the play of the Lungs, nor can the play of the Lungs impede the action of the Heart.

2*d*, That the Lungs are contained in distinct

Capsules, which have no communication with each other; hence the Lungs of opposite sides are independent of each other, and cannot press on each other when we lye on either side.

3*d*, That the elasticity of the Mediastinum may contribute to the drawing down the Ribs.

4*th*, That the contents of the Posterior Mediastinum cannot be much compressed by the weight of the superincumbent parts.

Sect. III.

OF THE CIRCULATING SYSTEM.

It has been observed in a preceding page, that the more nutritious part of our food, called *Chyle*,*

* As Mr Brande has published an analysis of the Chyle since the preceding sheet was printed, I have subjoined his account of that fluid. " The contents of the thoracic duct are subject to much variation. About four hours after an animal has taken food, provided digestion has not been interrupted, the fluid in the duct may be regarded as pure chyle; it is seen entering by the lacteals in considerable abundance, and is of an uniform whiteness throughout. At longer periods after a meal, the quantity of chyle begins to diminish; the appearance of the fluid in the duct is similar to that of milk and water; and lastly, where the animal has fasted for twenty-four hours or longer, the thoracic duct contains a transparent fluid which is pure lymph.

" A. The chyle has the following properties.

" 1. When collected without any admixture of blood, it is an opaque fluid of a perfectly white colour, without smell, and having a slightly salt taste, accompanied by a degree of sweetness.

flows through the Thoracic Duct, which joins the left Subclavian Vein near to its junction with the

" 2. The colour of litmus is not affected by it, nor that of paper stained with turmeric; but it slowly changes the blue colour of infusion of violets to green.

" 3. Its specific gravity is somewhat greater than that of water, but less than that of the blood; this, however, is probably liable to much variation.

" 4. In about ten minutes after it is removed from the duct, it assumes the appearance of a stiff jelly, which in the course of twenty-four hours gradually separates into two parts, producing a firm and contracted coagulum, surrounded by a transparent colourless fluid. These spontaneous changes, which I have observed in every instance where the chyle was examined at a proper period after taking food, are very similar to the coagulation of the blood and its subsequent separation into serum and crassamentum; they are also retarded and accelerated by similar means.

" B. 1. The coagulated portion bears a nearer resemblance to the caseous part of milk than to the fibrine of the blood.

" The fluid found in the thoracic duct of animals that have been kept for twenty-four hours without food, is perfectly transparent and colourless, and seems to differ in no respect from that which is contained in the lymphatic vessels. It may therefore be regarded as pure lymph.

" It has the following properties. *

" 1. It is miscible in every proportion with water.

" 2. It produces no change in vegetable colours.

" 3. It is neither coagulated by heat, nor acids, nor alcohol, but is generally rendered slightly turbid by the last reagent.

" 4. When evaporated to dryness, the residuum is very

* The term lymph has been applied indiscriminately to the tears, to the matter of encysted dropsy, and to some other animal fluids. Vide Aikin's Dictionary of Chemistry and Mineralogy, Art. Lymph.

left internal Jugular Vein, near to the Heart; from which there must be canals through which these fluids flow to every part of the body.

These canals have been called the Arteries; and by corresponding canals, called Veins, the blood returns to the Heart, or the trunks of the Veins are inserted into the Heart, from which the great Arteries take their origin. The Heart may be compared to a forcing machine, which assists in propelling the blood through the arterial system. Before proceeding to explain the structure and distribution of the Heart, the Arteries, and the Veins, it seems necessary to premise a very brief account of the nature of the blood, a subject which has engaged the attention of many philosophers.

The human Blood is of a red colour; has a

small in quantity, and slightly affects the colour of violet paper, changing it to green.

"5. By incineration in a platina crucible the residuum is found to contain a minute portion of muriate of soda; but I could not discover in it the slightest indications of iron.

"6. In the examination of this fluid, I availed myself with some advantage of those modes of electro-chemical analysis, which on a former occasion I have described to this Society.

"When the lymph was submitted to the electrical action of a battery, consisting of twenty pairs of four inch plates of copper and zinc, there was an evolution of alkaline matter at the negative surface, and portions of coagulated albumen were separated. As far as the small quantities on which I operated enabled me to ascertain, muriatic acid only was evolved at the positive surface."

soapy feel, a saline taste, and emits a watery halitus; and its specific gravity is about 1.0527, according to HALLER.

When blood has been allowed to remain at rest, it soon coagulates into a solid mass, of the consistence of curd; which separates itself into two parts, *the Serum*, and *the Cruor*. The proportions of the Serum and Cruor differ in different animals; in common, there are as three parts of Cruor to one of Serum.

The coagulation of the blood takes place in the open air, and also within close vessels; whether the blood be allowed to cool, or be kept at the temperature at which it is when it flows from a vein.

The Serum is of a light green colour; and its mean specific gravity is about 1.0287. When heated to the temperature of 156°, it coagulates, and has then a greyish colour, and somewhat resembles the boiled white of an egg; and from the coagulated Serum the serosity may be squeezed out.

If coagulated Serum be heated in a silver vessel, the surface of the silver becomes black: hence Serum contains sulphur; and, according to PROUST, the sulphur is combined with Ammonia, in the state of a hydro-sulphuret.

The Serum of the Blood also contains an alkali, which was supposed to be *Soda*. Dr PEARSON endeavoured to prove that it is potash; but the last experiments upon this subject by Dr MARCET have proved the alkali to be soda.

1000 Grains of Serum of Blood contain, according to Dr MARCET, *

Water - - - - - -	900
Albumen, (dry) - - - -	86.8
Muco-extractive matter, - - -	4.0
Muriate of Soda, with some muriate of Potash, - - - - -	6.6
Subcarbonate of Soda - - -	1.65
Sulphate of Potash, - - - -	0.35
Phosphates of Lime, Iron, and Magnesia	0.60
	1000.00

The following Table exhibits the general results of the constituents of the different animal fluids, analysed by Dr MARCET :—

Fluids examined.	Specific gravity.	In 1000 Grains of Fluid.		
		Solid contents.	Animal matter.	Saline matter.
		Grains.	Grains.	Grains.
Fluid of Spina Bifida -	1007	11.4	2.2	9.2
Hydrocephalus - - -	1006.7	9.2	1.12	8.08
Ascites - - - - - - -	1015	33.5	25.1	8.4
Hydrothorax - - - -	1012.1	26.6	18.8	7.8
Hydrops Pericardii - -	1014.3	33	25.5	7.5
Hydrocele - - - - -	1024.3	80	71.5	8.5
Serum of Blood - - -	1029.5	100	90.8	9.2

* Dr MARCET's experiments seem to prove, that the potash discovered by Dr PEARSON is in combination with the muriatic and other acids. Medico-Chirurg. Transact. London, Vol. 2.

Of the Cruor.

The Cruor, or Clot, is of a red colour, and its mean specific gravity is about 1.245 according to JURIN.

The Cruor, by being well washed, is in part dissolved, and a part remains upon the searce. Thus it may be separated into two parts; into a white, elastic, and solid substance, possessing the properties of *fibrin*; and the portion held in solution, which contains the colouring principle.

Many experiments have been made upon the above watery solution, which, according to BUQUET, contains albumen and iron.

Soda is also contained in the watery solution; for it gives a green colour to the syrup of violets.

Dr WELLS * endeavoured to prove, that the colouring principle of the blood was of an animal nature. Soon after FOURCROY and VAUQUELIN † made experiments upon the same subject, and imputed the colour of blood to a subphosphate of iron; which opinion has very lately been contradicted by Mr BRANDE, who has adopted Dr WELLS's opinion, and who has concluded that the colouring substance is of an animal nature; and, like many other animal colouring matters, may be employed in dyeing.

The words are—" There can, I think, be little " doubt that the formation of the colouring matter

* Philosoph. Trans. for 1797.

† Syst. des Conn. Chym. Tom. 8.

" of the blood is connected with the removal of a
" portion of carbon and hydrogen from that fluid,
" and that its various tints are dependent upon
" such modifications of animal matter, and not,
" as some have assumed, upon the different states
" of oxidizement of the iron which it has been
" supposed to contain."

Sect. IV.

OF THE STRUCTURE OF THE PERICARDIUM AND HEART.

The Heart is said to be contained within the Pericardium; though, to speak with accuracy, it is on the outer side of the Pericardium.

The Pericardium, which is double, is rough on its outer side; but on its inner side, remarkably smooth, and lubricated by a serous fluid, which has been analysed by Dr Bostock.* According to that author, 100 parts contain

Of water - - -	92.0
Albumen - -	5.5
Mucus - -	2.0
Muriate of Soda	0.5

The liquor Pericardii, which is poured out by invisible orifices, prevents the bad effects of friction.

The Pericardium is a fibrous membrane like the Dura Mater, which covers the Brain.

* *Vid.* Nicholson's Journal, Vol. XIV.

The fibres pass in different directions; and, in some places, are collected into fasciculi, and which, in others, cross each other.

The Pericardium, which in figure somewhat resembles a cone, is firmly supported in its situation by its external coat, which it receives from the Pleura: hence the Heart is not affected by the play of the Lungs during respiration.

The Pericardium also adheres to the middle tendon of the Diaphragm, and also to the muscular part of that muscle, opposite to the fifth Rib.

The Pericardium is much more capacious than the Heart, and capable of containing the Heart when all its cavities are distended at the same moment, (which never happens during life): hence the heart slides readily within the Pericardium, and thereby adapts itself in some measure to the situation of the body.

At the upper and anterior part the Pericardium is contracted, and forms a sort of process which surrounds the large vessels which are connected with the Heart; it is reflected upon the Aorta, Pulmonary Artery, and Veins; so that there cannot be said to be apertures in the Pericardium.

The Pericardium is also supported by the Mediastinum Anterius; hence the Bloodvessels of the Heart cannot be elongated and contracted in their diameter; and, from the same cause, the Heart cannot press upon the Lungs.

Of the Heart.

The situation of the Heart has a relation to that of the Lungs ; as the functions of the Heart and Lungs have an intimate relation to each other.

The lower surface is somewhat flattened, and rests on the Diaphragm ; the anterior surface is opposed to the Sternum. The right side of the Heart is thin, and longer than the left, and is hence called *Margo Acutus.* The left side of the Heart is thicker and obtuse ; and has hence been named *Margo Obtusus* by HALLER.

The Heart is hollow. It is divided into two sides by a partition ; and on each side there are two cavities.

The volume of the Heart is different in different subjects, even of the same age.

The Heart is a muscle of a conical form, covered by a reflection of the Pericardium, and by fat ; is situated behind the Breast-bone and the Cartilages of the true Ribs, having its basis turned towards the right side of the Breast-bone, and its point or apex directed obliquely forwards, and towards the left side ; so that, upon its point being elevated during the contraction of the Ventricles, it is raised between the Lobes which compose the Lungs of the left side, and strikes the side between the fifth and sixth Ribs.

The Heart is composed of a number of fine fleshy fibres, which follow different directions; some are extended longitudinally from the base to the apex of the Heart; others take an oblique or spiral course; and a third sort are placed in a transverse direction. The direction of the muscular fibres of the Heart has been well described by Dr WALTER CHARLETON, in his Inquiries into Human Nature, * by SENAC, † and by WOLFF. ‡

* "The disposition and configuration of the fibres of the Heart is extremely divers from that observed in all others (muscles.) For here the fibres are neither direct, nor parallel among themselves; but curve and spiral, and in wonderful manner variously interwoven and implicated; not by a texture like that by which wicker baskets are made, as VESALIUS imagined them to be, but disposed with a more admirable artifice. For, immediately under the outward membrane investing the Heart, from the basis of the Heart, and from the circular Tendinose Orifices of it, in which the *Vena Cava* and the *Vena Arteriosa* are terminated; as also from the beginnings of the *Aorta* and *Arteria Venosa*, is propagated a *stratum* or layer of Carnose fibres, which are almost æquidistant among themselves, and tending directly from the basis toward the Cone of the Heart; where, variously inflected and contexed, they are reflected toward the cavities or ventricles within the Heart. Under this *stratum* lie other layers of fibres, descending obliquely and spirally; which still more and more inclining toward the Cone, before they arrive thither, are decussated, and interwoven among themselves, and with other orders of fibres;

† *Vid.* Traité de la Structure du Cœur.

‡ *Vid.* Nov. Act. Acad. Scient. Petropol.

The human Heart is *double*; the anterior part being destined to propel the blood into the Lungs, the posterior through the rest of the body. Hence the terms *Pulmonic*, and *Systematic Hearts*, have not inaptly been applied to describe the different hearts, or different sides of the same heart.

The greater share of the internal surface of each of the cavities of the Heart is unequal, which arises from certain muscles being placed within them, called *Columnæ Carneæ*.

The cavities of the Heart are lined by a very thin, but dense, membrane, which prevents the blood from insinuating itself between the muscular fasciculi of the Heart.

On each side of the Heart there is an Auricle and a Ventricle; and the corresponding cavities in the opposite side of the Heart are different as to capacity,—as to the thickness of their Parietes, and the colour of their contents; the blood in the Anterior Heart being of a deep purple colour, and that of the Posterior Heart of a brilliant red colour.

fibres; and thence turned toward the inside of the Heart, they are partly reflected in oblique spires, and as it were fillets, running transverse, toward the basis of the Heart, and partly seem to compose the internal columns, to which the little chords of the *three-pointed* and the *mitral valves* are fastened; while other some of them, being transversely woven together, form the *Sinus* of the right Ventricle."

CHARLETON'S *Inquiries into Human Nature*, p. 39. London 1680.

The Ventricles constitute the most essential part of the Heart; they may be compared to a forcing machine, and therefore merit the most particular mention; the other cavities, called Auricles, being merely reservoirs, in which the blood is collected, during the contraction of the Ventricle.

Of the Pulmonic, or Anterior Part of the Heart.

The Anterior or Pulmonary Ventricle is somewhat triangular in form; very unequal internally, owing to the Columnæ Carneæ, the greater number of which adhere to the inner surface of the Heart, and are disposed in a longitudinal direction in respect to the Heart.

These Columnæ Carneæ render the Heart stronger, and also assist in preventing the coagulation of the blood.

The parts which communicate with the Ventricle are, the Anterior Auricle, and the artery through which the blood flows to the Lungs, called Pulmonary.

The Auricle is situated on the right, and rather towards the back part of the Heart; and upon laying it fully open, the projecting anterior flattened and notched part, which bears but a distant resemblance to the ear of a dog, is found to resemble the internal surface of the Ventricle; and the Columnæ Carneæ being disposed somewhat

like the teeth of a comb, have hence been named *Musculi Pectinati of the Auricle.*

The greater share of the Auricle is smooth, and has been named the *Sinus*, which seems to be the continuation of the large veins through which the blood flows into the Auricle, called Venæ Cavæ.

The muscular flesh of the Auricle is much thinner than that of the Ventricle, as the Auricle, by its contraction, merely propels the blood into the Ventricle.

In the quadruped, there is a distinct projection of that part of the Auricle, which intervenes between the entrance of the Vena Cava Superior, and Vena Cava Inferior: This has been named by LOWER, Tuberculum; and the same name has been transferred to the corresponding portion of the human Auricle.

The partition between the Auricles is semitransparent; and in the adult, towards its middle, an oval-shaped depression has been described, but it is rather of a circular form.

There is sometimes a small apêrture in the upper part of this depression, even in the adult; though generally there is no such aperture. This depression or fossa is bounded by a portion of muscle, which at its upper part has thick edges, and which has been described by VIESSENS under the name of *Isthmus.*

The Venæ Cavæ and also the Coronary Vein discharge their blood into the Anterior Auricle;

and over the termination of that vein there is a small valve of a crescentic shape.

There is an imperfect valve between the Vena Cava Inferior, and the Auricle, which is placed on the left side of the mouth of the Vena Cava Inferior, and which covers one half of the mouth of that vein.

This membrane is generally perforated; and its convex edge is fixed to the union of the Vena Cava and Auricle. *

Around the passage of communication, between the Auricle and Ventricle, a membrane, or, as some have called it, tendon, is placed.

There is a valve between the Auricle and Ventricle.

This valve consists of a circular fold of thin membrane, which is divided at its inferior part into several portions, three of which are more considerable than the others, and are connected by a number of threads of a determinate length, which are fixed to the Columnæ Carneæ of the Ventricle.

When the blood regurgitates, the different parts of the valve are thrust upwards, and form a complete barrier to the reflux of the blood; for this valve is so constructed, as to clap close to the side of the cavity when the stream of blood flows from the Auricle into the Ventricle; but it shuts up

* This Valve is admirably represented by SCARPA, in Plate V. of his Views of the Nerves of the Neck and Thorax.

the passage. When the Ventricle contracts, the three parts of the valve are raised up, and obstruct the passage.

Of the Pulmonary Artery.

This large artery takes its rise from the Anterior Ventricle, and its origin is marked by a callous ring; it passes upwards behind the Breast-bone, and divides into two great branches, through which the blood flows into the right and left Lungs.

To oppose the stream of blood from flowing backwards into the Ventricle, the internal coat of the artery is reflected, and forms three valves, somewhat of a semilunar figure, which yield before the stream of blood which flows from the Ventricle; but which, when it is refluent, are raised; and, with the aid of a small hard and red-coloured body, called the *Corpusculum Arantii*, completely obstruct the artery.

The Pulmonary Artery opposite to the valves is somewhat enlarged, forming what anatomists have named Sinuses, of which there are three.

The opposite sides of the Heart are separated from each other by a Septum, which is thicker than the flesh of the Posterior Ventricle, in which the muscular fibres of both Ventricles are intermixed; and, upon the Septum, there are a number of Columnæ Carneæ.

Of the Posterior, or Systematic Heart.

The blood which was circulated through the Lungs flows by the medium of the four Pulmonary Veins into the posterior part of the Heart.

The posterior Heart is very similar to the anterior in its structure.

There are four veins which communicate with the Auricle, which are rather smaller than the right; and the four Pulmonary Veins open into the upper and back part of the Auricle.

From the posterior Ventricle the large artery of the body issues, called Aorta; the connexion of which with the Ventricle has been accurately described by BARON HALLER.

" Caro Cordis in circuli perfecti formam terminatur, et fibræ transversæ Cordis, partim inter valvulas arteriosas per lineæ longitudinem producuntur, et aliquanto plus, partim in partem arteriæ, quæ sinum valvulosum perfecit, pariter sursum pergunt, fere per sesquilineam, et accurate transversæ cum alba pariter membrana arteriæ connectuntur, cellulosæ brevis telæ ope, ut nulla cordis fibram arteriam continuetur. " *

The auricular part of the posterior Auricle is longer, but not so broad as that of the anterior Auricle.

The valve between the Auricle and Ventricle is nearly similar to that of the anterior side of the

* HALLERI Element. Physiol. lib. iv.

Heart; but it is composed of two principal parts only, and has in shape been compared to a bishop's mitre; and hence called Valvula Mitralis.

The flesh of the posterior Ventricle is much thicker than that of the anterior Ventricle; and the cavity of the Ventricle is in shape somewhat like an egg, and rather smaller than that of the anterior Ventricle.

Bloodvessels of the Heart.

The Heart is supplied with blood by the Coronary Arteries, which are sent off from the Aorta immediately behind its valves.

The veins of the Heart unite, and form the Coronary Veins, which open into the anterior Auricle.

It has been affirmed, that both the smaller arteries, and also the veins, open upon the surface of the Auricles, and also upon the surface of the Ventricles. THEBESIUS wrote expressly on this subject: and hence, these apertures have been called the *Foramina Thebesii.*

I have seen a very penetrating liquor thrown with force into the Coronary Artery, and yet none of the liquor got into the cavities of the Heart.

Nerves of the Heart.

The Nerves of the Heart are derived from the eighth pair, and Sympathetic Nerves.

SECT. V.

GENERAL DESCRIPTION OF THE DISPOSITION OF THE ARTERIES.

By the Arteries, blood flows to every part of the body; and by the Veins it flows backwards; and the Heart is the machine which assists in propelling the blood, and which is placed where the Arteries and Veins meet, in order to restore to the blood the momentum it had lost during the circulation.

The blood, in passing outwards, flows from wider into narrower tubes; and in returning, from narrower into wider vessels.

The Arteries are placed on the inner sides of membranes, as far as possible out of danger. They pass within canals of the bones, as in the lower Jaw, or in grooves in the Ribs; and take advantage of the processes of the bones. They are placed on the bending sides of the Joints, otherwise they would be overstretched, and the flow of blood through them would be impeded.

The larger Arteries are seated much deeper than the Veins: The cutaneous branches of these are small and short; whereas many of the trunks of the veins are seated under the skin, and many of their smaller branches are deep seated.

The Arteries divide into numerous branches, somewhat like a tree; and are sent off from their

trunks at different angles; generally at an acute angle, and sometimes at a right or an obtuse angle; and at the place of the division, a projection may be observed on the inside of the artery, formed by the internal coat.

In general, the Arteries take the shortest road: thus less force is required. There are however some exceptions to the above observation; as in the case of the Arteries which lead to the Brain.

The smaller branches of the Arteries are more exposed, and more convoluted in their course, than the larger branches, and more especially those distributed upon organs which undergo a rapid alteration as to their size, as those of the Lips, Stomach and Uterus; and in other cases, this convoluted course is probably subservient to secretion. Thus, the Spermatic Artery follows a long and tortuous course before it reaches the body of the Testicle; and more especially that of quadrupeds.

The arterial system has generally been compared to a cone, of which the apex is at the heart.

The larger trunks of the Arteries are included in a considerable quantity of cellular substance; as in the Axilla, the Groin, &c.

The branches from these trunks approach nearer to the surface of the body; and these branches are subdivided into a number of smaller branches, and are more tortuous in their course.

It is evident, that the sum of the branches of an Artery, exceeds in diameter the trunks from

which they arise; which has been differently stated by HALLER,* SENAC, &c.

The Arteries in their course are frequently united, or they form repeated anastomoses.

Two large Arteries meet at an acute angle, and form a single trunk; or the arteries unite, and form arches, and the branches are given off from the convexity of the arch. Some Arteries, as the anterior Arteries of the Brain, are united by a transverse arch.

Of Varieties in the Arterial System.

The Arteries of the body gradually increase with the bulk of the body; and when the size of the part varies, so does that of the Artery proper to it.

These varieties are temporary, or permanent. The Gravid Uterus affords an example of the former. As that organ increases in bulk, its Arteries are much enlarged; but, after delivery, the bulk of the organ, and also that of its Arteries, are much diminished. In the same manner, the Arteries in the vicinity of a Tumour acquire an unnatural size; but upon the Tumour being removed, they shrink; but if that Tumour cannot be removed, the increase in the size of the vessel is permanent.

* *Vid.* HALLERI Element. Phys. lib. 2. sect. I.

When an Artery attains an unnatural bulk, it becomes tortuous, as it is fixed down at both ends.

Comparative Vascularity.

There are many more Bloodvessels proper to the several organs of a young animal, than to those of an old one.

It is a general law, that during the formation of a part, it is more amply supplied with Bloodvessels than after it has been formed.

All parts which are active, are best supplied with Blood. Thus, the Bones, Tendons, and Ligaments receive but a scanty supply of blood.

A large quantity of blood is sent to the Muscles, Glands, and organs of sense.

In some cases, blood is suddenly determined to a part, in order to increase its sensibility.

Of the Terminations of the Arteries.

The Arteries terminate in different ways.

Most of the branches of the Arteries, whether conveying the red or the colourless part of the blood, terminate directly in those Veins which convey the red part of the blood.

Many branches of the Arteries terminate upon Glands; others in exhaling Arteries, which lu-

bricate the surfaces of the Serous Membranes that line the Cranium, the Thorax, and Abdomen; besides which, there are numerous excerning Arteries upon the surface of the Skin, and internal surface of the Lungs.

Lastly, Some of the branches of the Arteries terminate in organs of a cellular structure, as the Penis and Clitoris.

In short, by the Capillary System many of the most important functions of the body are performed, as Nutrition, Secretion, Exhalation.

Before concluding this Section, it may not be improper to add, that irregularities in the origin and distribution of some of the branches of the Arteries are by no means uncommon.

Of the Veins.

The smaller branches of the Arteries are continuous with the Veins.

The capacity, and also the number of the Veins, surpasses that of the Arteries. But there are some exceptions to this rule: Thus, the Renal, Bronchial, and some other Veins, are smaller than the corresponding Arteries.

The Veins of different sizes unite, and the angles formed by their union are different; most frequently they are acute, but at other times obtuse.

The course of the Veins is not similar to that of the Arteries. There are many of the larger trunks of the Veins which lye under the skin; whereas the larger branches of the Arteries are deep seated.

The branches of the Veins communicate with each other more freely and more frequently than the branches of the Arteries; they communicate by a straight canal, or by arches; or the communications are so numerous as to form a plexus.

The communications between the branches of the Veins are most numerous, because the course of the blood in these is more apt to be interrupted by violent motion, by the effect of gravitation during our erect posture, or by external and internal pressure.

The Veins are provided with Valves, by which the blood flows readily in one direction only.

The Valves are formed by a reflexion of the innermost coat of the Vein; are of the figure of a parabola; are concave towards the Heart; and are generally disposed in pairs: and these Valves are perfectly similar to each other. These Valves are more numerous in some than in other Veins.

Single Valves are sometimes found in the Veins of the Hands and Feet.

Valves are found in those Veins particularly which are placed perpendicularly; as in those of the Limbs; and where the pressure occasioned by the contraction of the superincumbent muscles might have rendered the blood refluent.

Valves are also found in the Venæ Azygos and Spermatic Veins.

The blood gets between the Valves and the sides of the Veins, by which the Veins are expanded, which gives the Vein an irregular figure.

The last circumstance respecting the Veins, which merits particular mention, is, that the Veins yield more readily; are much more dilatable in the transverse direction, than the Arteries; but they can be extended but little in the longitudinal direction.

The Coats of the Veins are also much stronger than the Arteries, as has been proved by the experiments of SIR CLIFTON WINTRINGHAM.

Of the Coats of the Arteries and Veins.

The Arteries and Veins are connected to the neighbouring parts by loose cellular substance, by which they are more readily adapted to the movements of our Limb, and readily change their place when they are dilated, and when the pulse is felt.

The Coats of the Arteries are whiter, and considerably thicker, than those of the Veins; in some cases the Coats of the Arteries are thrice the thickness of those of the Veins.

The smaller Arteries are proportionally stronger than the larger; as has been ascertained by fixing weights to them.

The Arteries are less capacious, less numerous, but much more elastic than the Veins: hence

their sides do not collapse even when empty; hence an artery, when divided, presents a circular or oval mouth.

In consequence of the elasticity of an Artery, it yields, when the blood has been driven into it by the contraction of the Heart; and by the same means the Artery regains its former situation.

The Arteries and Veins are provided with an external cellular coat, composed of very fine threads, which connects it to the neighbouring parts; and which internally is condensed into a dense white layer, which covers even the more minute branches of the Arteries, with the exception of the Umbilical Arteries, and those within the Head.

In this Coat the elasticity of the Arteries chiefly resides.

The Nerves, and Vasa Vasorum, or the small Bloodvessels proper to the coats of the Artery, pass along this Coat.

The second Coat of the Artery is composed of circular muscular fibres; and the colour of these fibres varies somewhat in the different Arteries; being deeper in the Arteries of middle size, than in the trunk of the Aorta.

The third Coat of the Arteries is very thin, though not equally so in every part; being thinnest in the left Ventricle. It is transparent, and remarkably smooth.

Within the Thorax and Abdomen the Arteries

receive an additional coat from the Pleura and Peritonæum.

The Vasa Vasorum which are proper to the Coats of the Arteries and Veins, do not come directly from the trunk of the Artery itself, but from the neighbouring Arteries.

There are many Lymphatic Vessels which are proper to the Coats of the Arteries, otherwise their cavity could not be extended in proportion to the bulk of the body. There are also Nerves which are proper to the Coats of the Bloodvessels.

The Nerves have a great influence on the Arteries; they preserve their irritability, and consequently promote the circulation of the blood in the extreme branches, and maintain the functions of secretion.

Every part of the body is not supplied with the same number of Arteries and Nerves. The different organs are more or less sensible; which seems to depend upon the number and size of the Nerves proper to these.

The Brain, and organs of sense, are amply supplied with Arteries; and in many instances from different sources.

The Arterial and Nervous Systems have a great degree of sympathy with each other, and fit each other for their proper functions.

The mind, in most cases, has no influence upon the state of the circulation of the Blood; but when the Nervous System has been excited, the Blood circulates more quickly than usual.

When the action of the Arteries is increased, the Nerves are also affected; thus, by passions of the mind, palpitation is induced.

Voluptuous ideas determine the blood to the penis, and produce erection: Anger impels the blood into the smaller Arteries, and produces redness of the face.

Excessive grief or joy promotes the flow of tears, and impels the blood into the finer vessels of the skin.

An unusual flow of blood to a part increases its sensibility; as in an inflamed eye, or when the penis or clitoris are erected.

Inflammation renders the sense of touch more acute.

Grief impedes digestion, and diminishes the secretion of the Gastric Juice: On the other hand, a loaded Stomach blunts sensibility, and produces sleep.

Fear also augments the secretion of the mucus of the Intestines, and causes Diarrhœa.

The influence of the Nerves upon the Arteries is evident. By throwing a ligature upon a Nerve, the quantity of the fluid secreted by the gland is diminished.

Nuck found, that the division of the Nerves leading to the Salivary Glands diminished the usual quantity of Saliva.

An experiment which my Father performed, and of which an account is published in the Edinburgh Philosophical and Literary Essays, adds an

additional illustration of the sympathy which exists betwixt the Arteries and Nerves.

He found that, upon pouring a solution of opium under the skin of the thigh and leg of a living frog, not only the leg itself was very soon affected, but also the most distant organs of the body, by a sympathy of the Nerves; but when he cut out the Heart, or tied up or cut across the Bloodvessels of the Thigh, the distant parts of the body *were not affected ;* hence the cutting out the Heart, and throwing ligatures upon the Arteries, prevented the Nerves from propagating their influence by sympathy; and also proves the sympathy between the Arterial and Nervous Systems.

Lastly, the nervous action is not only influenced by the quantity, but also by the quality of the blood.

SECT. VI.

OBSERVATIONS ON THE CIRCULATION OF THE BLOOD.

I shall subjoin, in the form of induction from the preceding account of the Structure of the Heart, Arteries and Veins, a few very general observations respecting the Circulation of the Blood.

1. The blood which flows from the left side of the Heart is distributed by the arteries to almost every part of the body, and returns to the Heart

by means of the veins which terminate on the right side of that organ.

2. It is obvious that the structure of the Heart has a reference to the lungs; it is a double organ: There are two hearts, one proper to the lungs, another proper to the rest of the body; or there is a particular circulation through the lungs, and a general circulation through the rest of the body.

3. The Heart, Arteries and Veins are hollow muscles, and by contracting expel the included blood; and they are muscles of considerable strength, as has been proved by SIR CLIFTON WINTRINGHAM.

4. The contraction of the Heart is not excited by the will, that organ being an involuntary muscle. Nor does it depend upon the brain or nerves: For the Heart continues to contract after the head has been removed,* and also after

* My Father long ago remarked, in his book upon the Nervous System, that the heart of a frog continues to act for some time when cut out of the body; and also that a frog continues to live, and even to move its limbs for two days after it has been decapitated.

Mr CRUICKSHANKS* observed, that if an animal was pithed, by dividing the spinal marrow in the upper part of the neck, respiration ceased; but the heart continued to act, circulating dark coloured blood; and from ten to fifteen minutes elapsed before the circulation ceased.

Mr BICHAT † and Mr BRODIE ‡ have also remarked, that

* London Phil. Trans. for 1795.

† *Vid.* his Book Sur la Vie et Sur la Mort; also his Anat. General.

‡ *Vid.* London Phil. Trans. for 1810.

the nerves which lead to it have been divided. The Heart contracts in consequence of the presence of the blood, as has been proved by Baron Haller: The action of the Heart is also intimately connected with the change which the blood undergoes during its passage through the lungs; in proof of which, when the contractions of the Heart become languid, or have ceased, they may frequently be renovated by inflating the lungs.

5. The disposition of the muscular fibres of

the brain is not directly necessary to the action of the heart, and that when the functions of the brain are destroyed; the circulation ceases only in consequence of the suspension of respiration; and the latter gentleman also found, that if respiration was produced artificially, the heart continued to act for a still longer period after the removal of the brain.

Mr Brodie has drawn the following conclusions from his experiments.

'1. The influence of the brain is not directly necessary to the action of the heart.

'2. When the brain is injured or removed, the action of the heart ceases, only because respiration is under its influence; and if, under these circumstances, respiration is artificially produced, the circulation will still continue.

'3. When the influence of the brain is cut off, the secretion of urine appears to cease, and no heat is generated; notwithstanding the functions of respiration, and the circulation of the blood continue to be performed, and the usual changes in the appearance of the blood are produced in the lungs.

'4. When the air respired is colder than the natural temperature of the animal, the effect of respiration is not to generate, but to diminish animal heat.' *Vid.* Med. & Phys. Jour. Vol. XXVI. p. 67.

the Heart is very peculiar; and by their contraction, the included blood is expelled.

The Heart (as HARVEY calls it), the *fundamentum vitæ, princeps omnium*, is in the alternate state of contraction (or systole), and dilatation (or diastole), from the moment of our existence till the moment of death.

6. During the contraction of the Heart, it starts forwards, describes a portion of a circle, and strikes the side; which is to be imputed to the filling of the auricles placed at the base of the Heart, and to the sudden dilatation of the arch of the aorta; the anterior part of which is moveable, but the posterior part is fixed down.

During this contraction, the apex approaches its base; the sides of the ventricles are drawn towards the Septum Cordis, which is more fixed; and, from the corresponding cavities being filled at the same time, and being united by a common Septum, they must act at the same time.

The Auricles and Ventricles are successively contracted and dilated.

When, by the contraction of the Auricles, the blood which they have received by the Venæ Cavæ and Pulmonary Veins is expelled, the Ventricles are relaxed, and ready to receive the blood; and when the Ventricles contract, and expel their contents into the Pulmonary Artery and Aorta, the Auricles are relaxed.

7. In consequence of the contraction of the ventricles of the Heart, the blood is thrown with considerable force into the Pulmonary Artery and Aorta, and their ramifications; while the arteries, being exposed to the impulse of the blood from the ventricles, are provided with coats of considerable strength; which, being muscular, assist the Heart in propelling the blood; adapt themselves to the quantity of blood; and, in the case of bleeding, by their contraction stop the flow of blood.

8. That there is a muscular contractile power proper to the arteries, is evident from various circumstances.

A. From the effects of local stimuli, which excite an increased action of the arteries.

B. From a hæmorrhagy being stopped by the contraction of the coats of the artery.

C. From gangrene of the feet succeeding the ossification of the coats of the femoral artery.

D. From the circulation being continued when the Heart is wanting.

E. From the effects of palsy upon the Arteries.

9. When the Heart contracts, the Arteries are at that instant dilated; and in this state, we perceive their pulsatory motion. That the pulse is owing to the dilatation of the coats of the artery, may be made obvious (BICHAT states) by transfusing the blood from an artery of a living animal into the Humeral Artery of a dead body, which thereby acquires pulsation.

That the pulse is not owing to the contraction of the Coats of the Artery, has been fully proved by VESALIUS's Experiments. *

10. The arteries divide, like a tree, into various branches, most of which are sent off at acute angles; and these branches are subdivided into still smaller branches.

If the laws of hydraulics are applicable to the arterial system, the blood, in consequence of its viscidity, of friction, of the angles and anastomoses of the arteries, of mechanical pressure, and the greater area of the branches than of the parent trunk, should flow much more slowly in the smaller than in the larger trunks of the arteries.

The above holds true with regard to water contained in metalline tubes; but perhaps not with regard to blood circulating through the muscular and elastic blood-vessels of a living animal: An opinion which gains weight from the experiments of HALLER † and SPALLANZANI; ‡ who have stated, that they remarked the blood issuing as

* *Vid.* VESAL. de Corp. Human. Fabric. Lib. VII. cap. xix. p. 569. Lugdun. Batav. 1725.

† *Vid.* Element. Phys. Lib. 6. sect. 30.

‡ *Vid.* his Experiments on the Circulation of the Blood. 'I did not find,' he observes, 'that the blood, in passing 'out of the middle-sized arteries into their branches, experienced the least retardation from any difference in the 'capacity of the vessels, or the numerous angles they 'formed with one another; nor did the mode of circulation, whether languid or strong, oscillatory or intermit-

rapidly from the smaller as from the larger arteries.

11. The blood, which is distributed by the branches of the Arteries, is brought back again by the Veins, which are continued from the smaller branches of the arteries, as may be seen in the pellucid parts of animals; and, by throwing a penetrating liquor into an artery, it flows into the veins.

The smaller veins uniting, form the larger; whilst the larger, by their union, form the Vena Cava Superior and Inferior. The former brings back the blood from the upper, the latter from the under parts of the body.

12. The return of the blood through the veins to the Heart is promoted by the muscular power of the vessels themselves; the action of the adjoining muscles, and pulsation of neighbouring arteries; and perhaps also by the column of blood in the veins, which, being always full, the effect of the stream of blood *a tergo*, must be considerable in pushing on the blood. The reflux of the blood through the veins is prevented by the Valves within them.

13. The circulation of the Blood is proved by the structure of the Heart, Arteries, and Veins; and by Ligatures.

There are various causes which determine the

'tent, appear to be at all affected by the multiplicity of 'natural and artificial curvatures, or the flexures and con-'volutions made by the different ramifications.'

blood to follow a particular course. By means of the contraction of the Auricles, the blood flows into the Ventricles, from which it is propelled into the two great Arteries; and its reflux is prevented by the Valves placed between the Auricles and Ventricles, and at the mouths of the Pulmonary Artery and Aorta.

The different effects of pressure upon an Artery and Vein afford incontrovertible evidence of the circulation of the blood.

A ligature thrown around the Humeral Artery, prevents the flow of Blood to the fingers, and causes also a swelling of the artery between the ligature and the Heart. There is at the same time a swelling of the Veins between the ligature and the Fingers; the return of the Blood towards the Heart being impeded.

The circulation of the Blood is visible by the aid of the microscope; it may be imitated by an injection thrown into the arteries; and it is also proved by the loss of Blood an animal sustains by opening an artery.

14. One of the most important uses of the circulation is the distribution of nourishment to every part of the body.

CHAPTER II.

OF ASSIMILATION AND NUTRITION.

In the preceding chapter, it has been observed, that one great purpose of the circulation of the Blood, is the nutrition of the body.

During the performance of the several functions of the animal economy, there is a constant dissipation of the parts which enter into the composition of the body.

Every part of the human frame is in a state of constant change. The fluids are dissipated and the solids are abraded and absorbed, or much injured, by the various accidents to which, during the progress of life, we are exposed.

There must be some means for repairing the waste that is continually going on, and for the renovation of the various organs of the body when destroyed.

There is a necessity not only for a renewal of the fluids, but also of the solids.

The process by which the different parts of the body are renovated, has been called *The Process of Assimilation*, the nature of which process is very imperfectly understood.

I shall therefore content myself by stating a few facts relative to this important subject.

1. During infancy and youth, as the supply of nourishment exceeds the waste, the bulk of the body increases; but during manhood, the supply only equals the waste, whilst in old age the waste exceeds the supply; many of the smaller vessels become impervious, the fluids bear a less proportion to the solids, and the body shrinks and decays.

2. Every organ of Assimilation or Secretion produces upon the Blood a specific change.

Thus the Liver forms the Bile, the Stomach the Gastric Juice, and the Testes the Semen, &c.

3. Substances which cannot be acted upon by the organs of Assimilation, or which have a strong chemical attraction for the fluids prepared by the organs of Assimilation, continue, in some cases, to show their specific qualities. Thus, the urine is tainted when asparagus, onions, or turpentine, have been taken into the Stomach; or, thus, madder is combined with the phosphat of lime of the bones, to which it communicates a red colour.

4. But as changes similar to those produced by the organs of Assimilation, do not take place out of the body, the process of Assimilation *cannot be compared to a chemical process*, as it is in part the result of the action of the living principle.

Lastly. The process of Assimilation goes on for a certain time only, as the several organs of the body become, in process of time, incapable of

performing those functions which are necessary to the continuance of life.

CHAPTER III.

OF SECRETION.

The Secretions of all kinds are formed from the Blood, though the manner of their formation is still unknown.

The organized apparatus from which many of the secreted fluids are derived, has been called a *Gland*, or *Glandular Bowel.*

The Glands are largely supplied with blood; which is converted into various fluids, some of which are retained within the body, for the performance of some useful purpose; others are discharged from it.

Some of the Glands are placed near the surface of the body; as those under the skin, the Mammæ, Testes, the Salivary and Lachrymal Glands.

Other Glands, such as the Liver, Pancreas, and Kidneys, are deep-seated.

Some Glands are single, as the Liver and Pancreas; others are disposed in pairs, as the Kidneys, Lachrymal Glands, &c.

Some Glands are composed of distinct portions or Lobes, united by loose cellular Membrane; which are again subdivided into smaller Lobes, and these last into still smaller Lobules or Acini; and these Acini are visible, in many instances, to the naked eye; but, in other cases, only by the aid of the Microscope.

There is a large supply of blood sent to the Glands; and in some instances, as in the Kidney, the Artery bears a large proportion to the bulk of the Gland.

The Arteries proper to the Glands are, in many cases, found between the lobules of the Gland, and enveloped by a considerable quantity of cellular substance. The smaller branches, however, are differently arranged in the different Glands.

Two very different opinions have been entertained respecting the structure of Glands. According to MALPIGHI, * an Artery which has entered a Gland, ramifies very minutely through its substance, and ultimately terminates in a hollow cavity or *follicle*, from which the secreted fluid flows out by the excretory ducts of the Gland.

RUYSCH † has endeavoured, by his minute injections of the Blood-vessels of Glands, to overturn the above opinion; and, according to that distinguished anatomist, the Glands are made up

* *Vid.* his Exercit. de Structura Viscerum.

† *Vid.* his Letters to BOERHAAVE on the Structure of Glands.

of a congeries of Bloodvessels, with which the excretory ducts are continuous.

It still remains to be determined, whether either of the above opinions relative to the structure of Glands, be correct, and whether all Glands have the same structure. I am disposed, from an accurate examination of the various preparations of glands made by my Father, to conclude, that Glands have not a similar structure.

As none of the secreted fluids are found to exist in the blood, the term *Secretion* implies, not merely a filtering, but the formation of an entire new fluid.

The secreted fluids are very different from each other in taste, smell, colour, and consistency. Some are watery, others gelatinous, others oily; and they have therefore been arranged into classes, according to their chemical qualities, by FOURCROY and other chemists.

The different secreted fluids pass through the Excretory Ducts; the size of which is very various. The ducts of some Glands open separately, as those of the Mammæ, upon the surface of the Papilla of that organ; the ducts of other Glands, as those of the Tonsils, pour their contents into a blind sac; but, in other instances, all the excretory ducts are united into one large tube; and in the case of the liver and urinary organs, that large tube passes into a receptacle, within which the secreted fluid is retained for a time, and probably

undergoes some change, which renders it more fit for its peculiar office; or some part is reabsorbed before its expulsion.

It may be farther observed, that the contents of the different Glands are discharged, either upon the surface of the body, or into cavities, by means of ducts or tubes, all of which, as well as the cavities in which they are found, are lined by a mucous membrane.

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PART X.

CHAPTER I.

OF THE ORGANIC DERANGEMENTS OF THE VASCULAR SYSTEM.

SECT. I.

THE Heart, Arteries and Veins, from their structure, situation, and functions, are much exposed to Organic derangements.

The most frequent organic derangement of the Vascular System, is Ossification. It occurs generally between the muscular and internal Coats, or on the inner surface of this last; and, in its incipient state, appears in the form of small points, or of thin bony shells.

Such Ossifications more frequently occur in the Semilunar Valves, at the beginning of the Aorta, or on the Mitral Valve at the mouth of the Auricle, and are frequently attended with a dilatation of the diseased Artery, and with an enlargement, not only in the capacity of the left Ventricle, but of the substance and thickness of its muscular fibres.

SECT II.

OF ANEURISM OF THE ARTERIES.

BY Aneurism, is understood a diseased enlargement of a portion of an Artery, of which there are the following varieties. In the first, the circumference of the Artery is uniformly enlarged, constituting a round, circumscribed, pulsating Tumour, such as is represented in Plate XXXIII., and which forms what has been called the *Circumscribed True Aneurism.*

In some cases of this description, the Tumour is of an oblong figure, not distinctly circumscribed; and hence has been called *The Diffused True Aneurism.*

In the second kind of Aneurism, a Sac is found attached to the side of the Artery, with which it communicates by a narrow neck.

This kind of Aneurism has been particularly described by SENERTUS and SCARPA. The main trunk of the Artery, to which the Aneurism is attached, sometimes preserves its natural size; but, on other occasions, is considerably expanded, as in Plate XXXIV.

All Aneurisms, according to SCARPA, are occasioned by a solution of continuity, or rupture of the proper coats of an Artery, which is occasioned by a wound, a steatomatous, or earthy degeneration, a corroding ulcer, a rupture of the pro-

per Coats of an Artery, I mean the Internal or Muscular, without the concurrence of a preternatural dilatation of these Coats. Hence the blood is effused into the neighbouring cellular substance, which is condensed into a Cyst.

My GRANDFATHER has described what he has called a *Mixed Aneurism*, or that kind of Aneurism which is formed by the rupture of the true Aneurism, and the consequent effusion of blood into the adjacent Cellular Substance.

A dilatation of a cluster of the smaller Arteries sometimes takes place, forming the *Aneurism by Anastomosis* of MR JOHN BELL.

When an unnatural communication is established between a Vein and the Artery which lyes under it: this has been called by DR W. HUNTER the *Varicose Aneurism.*

A wound of an Artery has been said, by authors, to form a *False Aneurism.* The blood sometimes insinuates itself along the course of the principal artery and vein of the Limb, constituting an irregular oblong Aneurism. This has been called the *Diffused False Aneurism.*

SECT. IV.

OF INTERNAL ANEURISMS.

INTERNAL Aneurisms of the Arch of the Aorta are frequent in the middle and decline of life;

as also Aneurisms at the division of the Aorta into its great branches, the Iliacæ communes.

There are four varieties of Aneurisms of the Aorta: 1. There is a kind of Aneurism in which the Aorta is uniformly expanded for the space of four or five inches; and, in some more rare instances, for eight or ten inches.

2. In the second variety of Aneurism, the dilatation of the Aorta is very irregular; so that there seem to be in the Arch of the Aorta two or three distinct Tumours, which freely communicate with each other.

3. In the third variety of Aneurism, there is a Tumour of considerable bulk, which communicates by a narrow neck with one side of the Aorta.

4. The fourth variety of Aneurism of the Aorta may perhaps be described as a modification of the third; for it differs only from the preceding as to the uniform diameter and extent of the Tumour connected with the Arch of the Aorta. This kind of Aneurism, which bears a strong resemblance to those diverticula which are sometimes connected with the Intestines, has frequently been mistaken for an Aneurism of the Subclavian or Carotid Arteries.

When the Arch of the Aorta is in a state of Aneurism, its coats are generally somewhat thicker than common; and are so loosely connected as sometimes to separate spontaneously, and, as has been already stated, are frequently partially ossified.

Aneurisms of the Arch of the Aorta sometimes burst into the Pericardium, or, by their pressure, occasion the absorption of the Breastbone or Ribs, and form an external Tumour, which bursts in the course of a few months ; but, in a few instances, such Aneurisms are filled by coagulable Lymph, and do not prove fatal in consequence of rupture, but by irritating the lungs, and occasioning Phthisis Pulmonalis.

Sometimes the contents of the Aneurism burst into the left branch of the Windpipe.

In a few cases the Aneurism of the Arch of the Aorta extends backwards, and has caused, by its pressure, a caries of the Spine.

Aneurisms of the Pulmonary Artery are much more rare than those of the Aorta.

SECT. V.

OF ANEURISMS OF THE HEART.

THE posterior side of the Heart is frequently much extended, or in a state of Aneurism. This is connected with ossification of the Valves of the Aorta, which, becoming rigid, do not yield ; for a small chink only remains between these, by which the free flow or exit of blood from the Heart is much impeded.

When the Heart is dilated, its muscular parietes are generally much thickened ; sometimes,

though very rarely, they become thinner than in the healthy state. The dilatation is sometimes general; on other occasions, limited to one side of the Heart, or to one of the Ventricles and Auricles.

The Aneurism of the Heart is sometimes succeeded by the rupture of that organ.

Sect. VI.

OF INFLAMMATION, ABSCESS, MORTIFICATION, AND OSSIFICATION OF THE VASCULAR SYSTEM.

The Vascular System, owing to the structure of its Coats, is subject to different organic derangements. It is sometimes inflamed, especially the Heart.

Induration and abscesses of the Heart sometimes occur.

Mortification of the Heart has been described by Lieutaud. *

The greater share of the muscular flesh of the Heart has been converted into Cartilage, or Bone; and sometimes, though rarely, into a fatty substance.

The Valves of the Heart, and especially the Mitral Valve, are frequently thickened, indurated, or ossified.

Polypus has been described by the older au-

* *Vid.* Hist. Med. Vol. II. p. 33.

thors as a frequent disease of the Heart, but improperly; Polypi being generally formed at the instant of death, and very rarely during life.

SECT. VII.

OF ANEURISMS OF THE DESCENDING AORTA.

Aneurisms in all respects similar to those of the Arch of the Aorta which have been above described, sometimes occur in the course of the descending Aorta; and still more frequently, where the Aorta divides into its two great branches, the Iliacæ communes.

SECT. VIII.

OF THE ORGANIC DERANGEMENTS OF THE PERICARDIUM.

The diseases of the Pericardium are in all respects similar to those of the Pleuræ Costales.

This membrane is frequently inflamed, by which it is much thickened, and sometimes adheres to the surface of the Heart; and of this inflammation Dr CORVISART has described three varieties, the Acute, Subacute, and Chronic.

The Pericardium is sometimes ossified.

A watery fluid is frequently collected within

the Pericardium, where water is effused into the Sacs of the Pleuræ.

The Coats of the Coronary Arteries of the Heart have sometimes been ossified.

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EXPLANATION OF PLATES.

Explanation of Plate XXXIII.

This Engraving represents a large true Aneurism of the Arch of the Aorta.

A, The Heart which was not enlarged.

B, The Right Auricle of the Heart.

C, The Right Ventricle.

D, The Left Auricle.

E, The Left Ventricle.

F H I, The Aneurism of the Arch of the Aorta.

G, The Left Subclavian Artery.

L, The Gullet, separated from the Trachea by the Aneurism.

M, The under part of the Gullet.

N, The Windpipe.

P and Q, The Right and Left Branches of the Windpipe.

Explanation of Plate XXXIV.

This Plate also represents an Aneurism of the Aorta, but of a different kind from that represented in the last Engraving; for the Arch of the Aorta is much dilated; and there is, at the same

time, a large Tumour connected with the side of it.

A and B represent an outline of a part of the Heart.

C C, The enlarged Aorta.

D D D, The Branches arising from the Arch of the Aorta.

E E, A large Sac, communicating with the enlarged Aorta at the place marked by letter F.

Explanation of Plate XXXV.

This Plate represents an Aneurism of the Aorta, combined with an Enlargement and Ossification of the Coronary Arteries.

A, a part of the left Ventricle of the Heart.

D D, Mark the boundaries of the Enlarged Aorta.

E, The Mouth of one of the Enlarged and Ossified Coronary Arteries.

F, One of the Valves at the Mouth of the Aorta, which was much thickened and indurated.

G and H, Two of the Branches arising from the Arch of the Aorta, of their natural size.

PART XI.

SECT. I.

GENERAL OBSERVATIONS ON RESPIRATION, AND ON THE STRUCTURE OF THE THORAX AND LUNGS.

RESPIRATION is one of those functions which have been justly called *Vital*; for to live and breathe are synonymous terms. It consists of Inspiration, or the drawing in the air; and of Expiration, or the expelling it. For understanding, in a clear manner, the cause of the ingress and egress of the air, it is necessary to begin by describing the Thorax, the containing, and the Lungs, or contained part.

The Thorax is lined, and its contents are covered, connected, and supported by the Pleuræ, serous membranes, which are in all respects similar to the Peritonæum. The Pleuræ, after lining the Ribs, and Intercostal Muscles, form Capsules for the Lungs, which are placed side by side, and do not communicate with each other: Hence water, air, pus, or blood, do not pass from one side to the other; and the Lungs of opposite sides being

independent of each other, respiration may be continued, though the Lung of one side has been destroyed.

The Sacs, which contain the Lungs of opposite sides, being nearly in opposition, form the partition of the Chest called *Mediastinum Anterius*, which is connected to the Sternum and Cartilages of the Ribs of the left side of the Chest; and hence the Chest is divided into two cavities of unequal size.

The right and left Lungs are not exactly equal in length and breadth; the right being broader than the left, and also shorter; for the right side of the Diaphragm rises higher up into the Thorax than the left.

The Pleuræ which form the Mediastinum Anterius, are not in immediate contact with each other; for, at the upper part of the Sternum, the Thymus and a few Lymphatic Glands are interposed between its component layers and below the Heart, and the great bloodvessels included within the Pericardium.

The Pleuræ, after covering the right and left Lungs, are again united, and afterwards separated, to form the *Mediastinum Posterius*; a triangular space, in which the Aorta, Gullet, Lymphatic Glands, the Eighth Pair of Nerves, the lower end of the Trachea and Bronchi, are contained. The Pleuræ are reflected from the Posterior Mediastinum to cover the heads of the Ribs, the Lymphatic Vessels, Nerves, and their Ganglia.

SECT. II.

OF THE LUNGS.

The Lungs, which correspond in figure with the Thorax, are of a conical figure, broader below than above; convex before, behind, and laterally, and with the surface next the Heart somewhat flattened; and are concave below, where they are in contact with the Diaphragm.

The colour of the Lungs depends in some measure on the quantity of blood they contain; hence it varies in different parts of the organ, and is deepest in the lowest part of the Lungs, which contains the greatest quantity of blood. The Lungs of such only who have died suddenly from loss of blood, and in health, as the victims of the guillotine, communicate a correct idea of the colour of the Lungs; and in the bodies of such persons, according to the French anatomists, the Lungs of the adult are of a grey or pale colour.

The Lungs also vary somewhat as to colour at different periods of life; those of an infant being rather redder than those of the aged, and not spotted like the latter.

The Lungs communicate to the touch a spongy feeling, on account of the numerous air vessels and air cells which enter into their composition.

For a similar reason they float on the surface of water.

Of the Lobes and Lobules of the Lungs.

The Lungs consist of Lobes; of which there are three on the right side, and two on the left. Each Lobe is divided into its component irregular shaped Lobules, which are united by cellular substance.

Of the Coats of the Lungs.

There are two Coats proper to the Lungs, the external of which is derived from the Pleura, and which covers only their surface; whereas the internal not only covers the greater Lobes, but enters between the component Lobules of the Lungs.

These Coats adhere so intimately to each other in the adult as to be separated with difficulty; but in the fœtus, they may be readily separated from each other.

SECT. III.

OF THE AIR TUBES AND AIR CELLS OF THE LUNGS.

The atmospherical air, owing to its weight, enters the Lungs through the Cartilago-membranous Tube, called the *Trachea* or *Windpipe*, or *Aspera*

Arteria, on account of the Cartilages which project from its surface, and render it to the touch rough.

The Trachea is placed at the fore part of the Neck, and connected to the under part of the Larynx, where it is covered only by skin and cellular membrane; but a little lower by the Thyroid Gland; and towards the under part of the Neck it lyes deeper, and is in part covered by the Sterno-hyoid, and Sterno-thyroid Muscles.

The Trachea is divided nearly opposite to the Third Dorsal Vertebra, into two great branches called *Bronchi*, one of which passes to the right, the other to the left Lungs. These branches are of unequal diameter; the left is the smaller and longer, and passes under the Arch of the Aorta, before penetrating the substance of the Lungs; whereas the right dips immediately into the Lungs.

The Bronchi are subdivided into a great number of small branches, which are distributed through every part of the Lungs, and each branch of which has its corresponding Artery and Vein.

The Cartilages of the Trachea are various in number, according to the length of the Neck; generally we meet with sixteen of them. They are placed horizontally, in respect to the axis of the Windpipe; are bent forwards like a bow; are uniform in length and thickness; are continued around about two-thirds of the Windpipe, which

is rounded before, but flattened behind, where it is in contact with the Gullet.

The Trachea and its branches are lined by a very irritable mucous membrane, which is kept constantly moist by Mucus which is derived from a number of mucous glands, situated at the back part of the Windpipe, and between its Cartilages.

The Cartilages of the Windpipe are connected by a ligamentous elastic Coat; and between it and the mucous lining there are muscular fibres, arranged in a circular and longitudinal direction.

The Bronchi are similar to the Trachea in structure, excepting in being surrounded by irregular segments of Cartilage.

The Bronchi are subdivided into still smaller branches, called the Membranous Tubes, which lead to the Air Cells of the Lungs.

Of the Air Cells of the Lungs.

The Air Cells of the Lungs may be demonstrated by inflating the Lungs, or by filling them with quicksilver, and afterwards drying and cutting the Lungs. They vary in size in different animals, being largest in the amphibia; and, even in the same class of animals, their size does not correspond with the size of the animal.

The surface of the Air Cells in the human body is much greater than that of the skin; and has been differently estimated by authors.

SECT. IV.

OF THE BLOODVESSELS OF THE LUNGS.

The Bloodvessels constitute a very important part of the organs of respiration. The purpose of respiration being to produce a change on the blood, by the operation of the atmospherical air, the Lungs are constructed in such a manner that fresh portions of atmospherical air are successively admitted into them; to which the blood is exposed: and thus, not only its colour, but also its properties, are materially altered; and it is rendered capable of stimulating the Heart, the Brain, and other organs of the body, to the due performance of their several functions in the animal economy.

The bloodvessels of the Lungs are derived from two different sources, the *Pulmonary* and *Bronchial Arteries*. The Pulmonary Artery takes its rise from the upper and anterior part of the Anterior Ventricle of the Heart; it divides into two great branches, which supply the right and left Lungs. Each of these branches is subdivided into a great number of smaller branches; which are distributed through every part of the substance of the Lungs, and on the air cells, in the form of a net-work. The corresponding Pulmonary Veins are united, and at length form four large veins, which dis-

charge their contents into the Posterior Auricle. The Bronchial Arteries take their rise from the descending Aorta; the branches of these arteries are distributed chiefly upon the Bronchi.

The corresponding veins join with the Vena Azygos, and Left Intercostal Vein.

Of the Lymphatic Vessels of the Lungs.

There are two sets of *Lymphatic Vessels* proper to the Lungs; a superficial, and deeper seated set; which freely communicate with each other, and pass into the Bronchial Glands; which last are chiefly placed where the Trachea divides into its two great branches.

Nerves of the Lungs.

The Nerves of the Lungs are derived from the Plexuses formed by the union of the eighth pair, and Sympathetic Nerves.

SECT. V.

OF THE MECHANISM BY WHICH RESPIRATION IS PERFORMED.

Respiration consists in the alternate reception and expulsion of the air from the Lungs, or of *Inspiration* and *Expiration*.

The Lungs, during respiration, are passive, and follow the motions of the Chest; and have not

inaptly been compared to a pair of bellows containing an empty bladder, the neck of which is so adapted to the boards of the bellows, as to admit the air on the boards being separated from each other.

The Muscles by which Respiration is performed belong to that class of muscles which have been called *Mixed*; as we can retard, accelerate, or stop, for a short time only, the action of these muscles.

Of the Muscles by which Inspiration is accomplished.

The Muscles more immediately concerned in Inspiration are, the *Intercostal Muscles* and *Diaphragm*.

Of the Intercostal Muscles.

There are two strata of Intercostal Muscles, which are oblique muscles, and with their fibres crossing each other. The *external stratum* arises from the under edge of each Rib, excepting the twelfth, and runs obliquely downwards and forwards from the Spine to the union of the Ribs, with their Cartilages, and is fixed into the upper edge of each Rib.

There are portions of the External Intercostal Muscles which arise from the transverse processes of the Vertebræ, and have been named *Levatores Costarum Breviores et Longiores*.

The origin of the *Internal Intercostal Muscles* is similar to that of the External. They run downwards and backwards, crossing the former stratum, and are continued as far as the angles of the Ribs.

The external Stratum is not found between the Cartilages of the Ribs and the Breastbone; nor the Internal Stratum between the Angles of the Ribs, and Spine.

Both Strata are subservient to the elevation of the Ribs. My FATHER, speaking of this subject, has observed,

'The chief circumstances which prove beyond a doubt, that the two rows of Intercostal Muscles conspire in elevating the Ribs, are,

'1. That the first Rib is so much fixed at both its ends as to be almost immoveable; and its Cartilage, instead of being connected to the Sternum by a capsular ligament, or articulated with it in the same manner as the Cartilages of the other Ribs, grows as firmly to the Sternum as to the Rib.

'2. That the second Rib is more fixed than the third; and the third more fixed than the fourth; and so on downwards.

'3. That as the Ribs, from the first Rib downwards, grow gradually longer, and describe portions of larger circles, we may observe, that in general, (or when we examine a middle portion of the Intercostal Muscles, or a portion half way between the Sternum and Vertebræ, the insertion

of the lower end of the portion is at a greater distance from either end of the lower Rib, or from a straight line drawn between the two ends of that Rib, than its origin in the Rib above is from the two ends of that Rib, or from a straight line drawn between them. Hence, whether we consider the head of the Rib, connected with the Vertebræ, as its centre of motion, or whether we consider the Rib as moving upon a straight line or axis drawn between its two ends, it follows, that a muscle placed between two Ribs acts with a longer lever upon the under Rib than upon the upper one, and therefore must elevate the under Rib.

'4. To determine the effect of the contraction of any muscle, I apprehend, we need only to observe in the dead body what the situation is in which the muscle in question is relaxed. Applying this rule, we shall find, that the whole Intercostal Muscles, internal as well as external, are shortened when we elevate the Ribs, and place them in that situation in which we find they are in inspiration.

'5. If the Internal Intercostal Muscles had been intended for the depression of the Ribs, we certainly should not have found them continued to the Sternum, because their anterior ends are fixed above to the edge of the Sternum, or so near to the insertion of the Cartilage of the upper Rib in the Sternum; and their inferior ends are, in consequence of their obliquity, fixed to the under

Rib so much farther from the Sternum, that they must act upon the under Rib with more advantage of lever, or are intended for its elevation.

'On the other hand, if the Internal Intercostals had been intended for the depression of the Ribs, we certainly should have found them continued backwards to the Spine; because, from their obliquity, their under end would have been fixed to the Vertebræ, or nearer to the head of the Rib, and their upper end at such a distance from it, that this portion of the muscle would have been better calculated than any other portion of it for the depression of the Rib.

'6. In a few experiments which I made on living animals, soon after I began to study anatomy, and which I repeated afterwards, particularly in 1770, I saw plainly, as Dr Haller had done, that both rows of Intercostal Muscles were in action during inspiration.

'Let us now consider the purpose,

'First, Of the obliquity of the fibres in the Intercostal Muscles; and,

'Secondly, Of their being disposed in two layers, the fibres of which decussate each other.

'It is evident, that the obliquity of the fibres here is not intended to increase their number, or the strength of the muscle, because the fibres would have been more numerous if they had passed directly from the one Rib to the other, or had been inserted into the Ribs at right angles.

'I apprehend, therefore, that we are to explain

the reasons of the structure in the following manner:

'Nature, in order to give protection to the Heart and Lungs, has formed the Ribs as broad and flat as possible, or left no more space between them than is required for lodging muscles for their motion in respiration. Consistently with this view, as the Ribs are fixed at both ends, so that they cannot be moved backwards and forwards, but are confined to motion upwards and downwards, remaining nearly parallel to each other, oblique muscles are preferred to straight; for if the former can, as I have before demonstrated, perform more extensive motion than the latter, even where both are of the same length, they must have a still greater effect, where the two kinds of muscles are confined between the same parallels.

'Thus, suppose the direct distance, or perpendicular drawn from one Rib to another, to be represented by three parts; and that the Intercostal Muscle, in consequence of its obliquity, measures five such parts; and that each of these is capable, when in action, of shortening itself one-fifth part of its length; it appears from the demonstration, that the oblique muscle can move the Rib through a space five times greater than the straight muscle can do.

'On accurate mensuration, I found the length of the Intercostal Muscle to be one inch and a

half, the perpendicular line one inch, and the base about one and one-eighth inch. Hence, calculating on the supposition, that the muscular fibre, in action, shortens itself one-fifth of its length, it will be found, that the Intercostal Muscles, in consequence of their obliquity, produce a greater motion of the Ribs than perpendicular muscles could have done, nearly in the proportion of 35 to 12.

'The only point remaining to be explained, is, why nature hath formed two layers of Intercostal Muscles decussating each other.

'The purpose of this, I apprehend, is to render the motion of the Rib upwards as direct as possible, and to prevent it from being drawn or pressed forwards upon the Sternum, or backwards upon the Vertebræ, so much as, by its friction, to interrupt the freedom of its motion.

'Upon the whole, by the obliquity of the Intercostal Muscles, the motion of the Ribs is very much greater than could have been performed by straight muscles placed between them. At the same time, by their consisting of two layers, or two muscles decussating and balancing each other, the motion of the Ribs, upwards and downwards, is as direct, and with as little friction, as if it had been performed by straight or perpendicular muscles.'

Of the Diaphragm, or Muscular Partition between the Chest and Abdomen.

In the natural state of Respiration, this muscle is the principal agent.

This muscle is convex towards the Thorax during expiration, and concave towards the Abdomen. It is composed of two distinct muscles, called *the Larger or Upper*, and *the Under or Smaller Diaphragm.* The Larger Diaphragm takes its rise from the Ensiform Cartilage, from the Cartilages of the Seventh and Lower Ribs on both sides; and the fleshy fibres meet in a central tendon, which somewhat resembles the Heart in figure. On the right side of this Central Tendon, there is an aperture for the Vena Cava Inferior. This muscle is covered next the Chest by the Pleura, and next the Abdomen by the Peritonæum.

The Smaller Diaphragm takes its rise by four Crura of unequal length. The Longer Crura arise from the fore part of the Fourth Lumbar Vertebra, and adhere to all the Vertebræ of the Loins, by means of a strong ligament. Between these Crura, there is an oval-shaped aperture for the Aorta and Thoracic Duct.

The muscular fibres of the several organs of this muscle ascend, and in the middle unite, so as to form two fleshy columns, which cross each

other; and between these the Gullet is placed. This smaller muscle also is fixed into the Central Cordiform Tendon. The Larger and Smaller Diaphragm are powerful muscles in respiration, and several other actions.

During inspiration, the capacity of the Thorax is increased in three different directions. By the descent of the lateral muscular portions of the Diaphragm, and by the ascent of the Ribs, which are placed obliquely in respect to the Spine, the Thorax is rendered longer; and, by the Ribs being thrust outwards, during their ascent, the transverse diameter of the Chest is increased; and, in consequence of the Breastbone being thrust forwards during the elevation of the Ribs, the Thorax is rendered deeper, and the distance between the Breastbone and Vertebræ becomes greater.

Respiration may be performed chiefly or solely by the Intercostal Muscles, or Diaphragm. The Intercostal Muscles are chiefly employed when the descent of the Diaphragm is impeded by the unusual bulk of the bowels of the Belly or Pelvis; as in cases of pregnancy, or in cases of the inflammation of the Peritonæum. On the other hand, the Diaphragm is the sole or the principal agent in respiration when the Ribs are broken; or when their motion is rendered very painful by an inflammation of the Pleura; or when their cartilages become rigid, or are reduced to a state of bone, as frequently happens during old age.

Of the Muscles of Expiration.

The Muscles of the Parietes of the Abdomen are the principal agents by which Expiration is performed, to which the elastic reaction of the Cartilages of the Ribs which had been twisted during inspiration, also contributes.

There are several other muscles which may be occasionally brought into action during expiration.

SECT. VI.

OF THE EFFECTS OF RESPIRATION ON THE BLOOD.

THAT the Blood undergoes some very remarkable change during its passage through the Lungs, during which it is exposed to the influence of the atmospherical air, has been long known and may be distinctly seen by opening a living animal—by exposing venous blood to a stream of oxygene air—by diverting the blood from the Lungs ;—and the remarkable symptoms which occur when all the blood does not pass through the Lungs, distinctly prove the effect of Respiration upon the blood.

Sect. VII.

OF THE EFFECTS OF RESPIRATION UPON THE ATMOSPHERICAL AIR.

The quantity of air which is inspired has been very differently rated. According to the most accurate experiments, about forty cubic inches of air are inspired.

Air that has passed through the Lungs differs from atmospherical air, 1st, In containing a considerable proportion of carbonic acid gas, as was distinctly proved by Dr Black, by expiring through lime-water, which is thereby rendered turbid, the carbonate of lime being insoluble in water.

2. Air that has been breathed contains less oxygene gas.

3. The bulk of the inspired air is somewhat diminished.

The quantity of air that is expired is nearly equal to that which is inspired.

There is also a small quantity of an aqueous vapour discharged from the Lungs.

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PART XII.

CHAPTER I.

OF THE ORGANIC DERANGEMENTS OF THE LUNGS.

SECT I.

OF INFLAMMATION OF THE LUNGS.

INFLAMMATION of the Lungs is extremely frequent in our variable climate; and the Lungs, when so diseased, bear a strong resemblance, in consistence and colour, to the Liver, being redder than the healthy Lungs, and so solid as to sink in water. The inflammation is on some occasions general, on others partial; and the inflamed part is frequently covered by a layer of coagulable Lymph, the thickness of which varies in different cases, by which the Lungs are firmly fixed to the Pleura Costalis.

The inflammation of the Lungs is often accompanied by an inflammation of the Pleura, and by an effusion of turbid serum into the Sac of the Pleura of the affected side.

Abscesses of different sizes, and also effused blood, have been found in different parts of the

substance of the Lungs; and when the Pus is lodged in the cavity of the Pleura, the disease has been called *Empyema*.

The Lungs have been sometimes, though very rarely, reduced to a state of gangrene.

Tubercle is the most frequent organic derangement of the Lungs, of which Dr Stark has given the most accurate account. Tubercles, according to Dr Stark, are generally seated in the upper and posterior parts of the Left Lungs, are of a whitish colour and cartilaginous consistence, and, when small, are solid, and always found in the cellular substance of the Lungs, and often in clusters. *

At first they are very small, commonly numerous; and, when they attain a certain size, matter

* Some authors have supposed Tubercles to be diseased Lymphatic Glands; though anatomists have not, hitherto, detected Lymphatic Glands in the healthy Lungs; and for the following reasons.

1. Because disease has discovered Lymphatic Glands and Lymphatic Vessels in many parts of the human body which had been supposed to be destitute of these.

2. Because Tubercles of the Lungs bear a striking resemblance to the Lymphatic Glands in colour and consistence, and to other diseased Lymphatic Glands, as those of the Mesentery and Neck.

3. As Tubercles are often observed in clusters like diseased Lymphatic Glands.

4. As Tubercles undergo the same morbid changes as diseased Lymphatic Glands; and, where diseased, as filled by similar contents.

is formed in their centre, by which they are converted into *Vomicæ*; during this they do not exhibit an appearance of inflammation; and no bloodvessels can be seen on them even by the aid of the microscope. He has also stated, that Vomicæ, the cavities of which are less than half an inch in diameter, are always quite shut, having no opening into the Bronchia, until they arrive at a size beyond this; but that those which are larger, have constantly one, two, or more ramifications of the Bronchia opening into them, through which the matter in some instances makes its way into the Trachea, and is evacuated without a rupture of the Vomica. * That the largest Vomicæ only are found ruptured; and, when that is the case, there is an alteration in the appearance of the matter contained in them. The same author also states, as an effect of Tubercles of a certain size, the rendering a part of the Lungs near them red, hard, and impervious to air, the destruction of the smaller vessels, and a contraction of the diameter of the larger vessels, which are frequently filled by a kind of fibrous substance. DR STARK has also added, that the branches of the Trachea which communicate with the Vomicæ, are on no occasion contracted or obstructed, though their internal surface is always red and inflamed.

A kind of tubercle, called the Brown Tubercle, has also been described by DR BAILLIE.

* Vid. London Med. Com. Vol I. p. 392.

The Air Cells of the Lungs are sometimes much enlarged in the asthmatic, and sometimes ruptured from Hooping Cough.

The Lungs are sometimes, in part, reduced to a state of Cartilage, within the centre of which Ossification takes place.

Hydatids are sometimes attached to the Lungs.

The Lungs have sometimes been ruptured by the Ribs being beaten inwards, or in consequence of excessive screaming.

Masses of coagulable Lymph are sometimes found within the branches of the Trachea, of which they take an exact mould.

Cretaceous-like concretions are sometimes coughed up from the Lungs.

In order to discover the composition of these Concretions found in the Lungs, I sent two or three of them to Mr John Davy, and requested of him to examine them; at the same time I sent to him a Concretion which had been lodged in the Trachea, and also a Concretion which had been obtained from the Duct of the Parotid Gland.

Mr Davy has favoured me with the following account of the above Concretions.

'My Dear Sir,

'I have examined the Concretions 'you put into my hands; and, from my experi- 'ments, they seem to approach very nearly to 'the nature of bone, not differing from bone in 'composition more than different kinds of bone

'do from each other; and their physical properties and general appearance are agreeable to this idea. It is unnecessary to describe the experiments I made on them, as the methods I employed were those commonly used in such analyses. I shall confine myself solely to a statement of the results.

'The Concretion from the Lung of the gentleman who died of Phthisis Pulmonalis appears to contain in the 100 parts—

'12.9 Cartilage,
'66.7 Phosphat of Lime,
'20.4 Water, probably, and Gelatine.

'100.0

'100 parts of the Salivary Concretion consisted of—

'34.6 Cartilage,
'46.2 Phosphat of Lime,
'19.2 Water, probably, and Gelatine.

'100.0

'100 parts of the Concretion from the Trachea consisted of—

'20.8 Cartilage,
'58.3 Phosphat of Lime,
'20.9 Water, probably, and Gelatine.

'100.0

'The Water and Gelatine were not immedi-
'ately obtained; but were inferred from the loss
'that occurred in the respective analyses.

'I remain, dear Sir, your, &c.

'J. DAVY.'

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PART XIII.

CHAPTER I.

Sect. I.

OF THE LARYNX.

The Larynx, which forms the fore part of the Pharynx, is placed between the Os Hyoides, and upper part of the Windpipe; and is composed of Cartilages, united to each other by Membranes, Ligaments and Muscles, by which the Cartilages are moved.

The Larynx is considerably broader above than below, and is symmetrical in form, its opposite sides being similar to each other.

The size of the Larynx is not proportioned to the body.

The size of the Larynx is also very various in different sexes. It is considerably broader in the male than in the female, and more prominent in its fore part in the former than in the latter, in which it is more rounded.

Castration has also a considerable effect on the growth of the Larynx; for that of the eunuch is never expanded like that of the perfect male. Five Cartilages have been described as being proper to the Larynx; but one of these is merely the lid which covers the Larynx.

Of the Thyroid Cartilage.

The largest Cartilage has been called *Thyroid*, from its supposed resemblance to a shield. It occupies the fore and lateral parts of the Larynx, and consists of two wings, which are united before, and form that prominence in the fore part of the neck so remarkable in the male, called the *Pomum Adami*, in the upper part of which there is a notch.

The wings of the Thyroid Cartilage, when spread out, are somewhat of a square form, and are somewhat externally concave, and their concavities lodge the Thyro-hyoid Muscles.

The superior surface of the Thyroid Cartilage is connected by a distinct membrane to the Os Hyoides; and from its posterior Cornua, there are two ascending portions, which are united to the Os Hyoides by round ligaments.

The inferior surfaces of this Cartilage are shorter than the superior, are curved backwards, and united with the articulating surfaces of the Cricoid Cartilage.

Of the Cricoid Cartilage.

The Cricoid Cartilage forms the base on which the Thyroid and Arytenoid Cartilages are fixed by means of articular surfaces. This Cartilage is circular, and narrower before than behind, where it rises up between the wings of the Thyroid Cartilage; and on this posterior part of the Cartilage there are smooth surfaces, by which the Arytenoid Cartilages are articulated with the Cricoid Cartilage.

The posterior surface is divided by a ridge into two lateral cavities for the Crico-Arytenoidei Postici Muscles.

The inferior part of the Cricoid Cartilage is placed horizontally, and is connected with the upper part of the Windpipe.

The superior part of this Cartilage is connected to the Thyroid by a distinct membrane, and rises up between the wings of the Thyroid Cartilage.

Of the Arytenoid or Pyramidal Cartilages.

The Arytenoid Cartilages constitute the most important part of the Larynx, being connected with the Chords, upon the state of which the voice more immediately depends; and the movements of these Cartilages tend also to the enlargement, or diminution, of the aperture of the Glottis.

These Cartilages are of a triangular figure, with their apices bent backwards.

The posterior surface of the Arytenoid Cartilages is filled up by the Arytenoid Muscles. The anterior surface is convex, with slight excavatures, which are occupied by the Arytenoid Glands.

The Arytenoid Cartilages are connected to each other by the membrane of the Larynx, and by muscular fibres; and also to the Epiglottis, by a membranous fold on each side, which form the sides of the upper aperture of the Larynx. On the above membrane a very few muscular fibres may be observed in very robust men, which have been described as muscles by some anatomists.

Of the Epiglottis.

The opening into the Larynx is covered by the Ligamento-Cartilaginous substance, which in figure resembles the Tongue, and which has been called the *Epiglottis:* when raised, it is placed perpendicularly; and where the Tongue is depressed, it is pressed down, and covers the passage into the Larynx, as in the act of swallowing.

The Epiglottis is fixed by its under end, by means of a short ligament, to the middle notch of the Thyroid Gland; and it is connected laterally to the whole length of the Arytenoid Cartilages.

There are a number of *Fissures* or *Lacunæ*,

the orifices of *Mucous Follicles*, on the surface of the membrane which lines the Epiglottis.

SECT. II.

OF THE LIGAMENTS OF THE LARYNX, OR THE VOCAL CHORDS.

THE Vocal Chords, which are about half an inch long, extend between the Arytenoid Cartilages and the angle formed by the junction of the wings of the Thyroid Cartilage; and between these there is a chink, of a triangular form, called the *Rima Glottidis*.

There are also two Vocal Chords, which are somewhat larger than the preceding, which extend between the bases of the Arytenoid and Thyroid Cartilages; and between the superior and inferior Vocal Chords there is a small cavity, capable of admitting the point of the little finger, called the *Ventricle of the Larynx*.

The Larynx is lined by a very sensible mucous membrane, which forms opposite to the Arytenoid Cartilages a horizontal fold, that passes directly forwards, and is joined to the angle formed by the wings of the Thyroid Cartilage.

The membrane is continued downwards; it lines the cavities called Ventricles of the Larynx, and then forms a second fold, which bounds the Ventricles below; and it also lines the Vocal

Chords; and afterwards the Trachea and its branches.

On the surface of this membrane there are many orifices of mucous ducts.

SECT. III.

OF THE MUSCLES OF THE LARYNX.

THE Larynx is moved as a whole by the muscles proper to other parts; and its component Cartilages are also moved upon each other, by muscles which are implanted upon it.

The greater number of the Muscles of the Larynx are connected with the Arytenoid Cartilages, to which the Vocal Cords are fixed.

If the Thyroid Cartilage be moved forwards, and the two Arytenoid Cartilages be drawn backwards at the same time, the Vocal Chords must be made tense; and if, on the contrary, the Arytenoid Cartilages be moved forwards, these chords will be relaxed. If the Arytenoid Cartilages be drawn outwards, or separated from each other, the space between the Vocal Chords called Glottis will be made wider, or dilated; and if, on the contrary, the Arytenoid Cartilages are drawn nearer to each other, the Glottis will be constricted or shut.

For these several actions certain muscles are appropriated.

Arytenoideus Transversus.

The packet of muscular fibres which constitutes this muscle, are disposed transversely between the Arytenoid Cartilages; by which these Cartilages are drawn close to each other; and hence the Glottis is shut.

Arytenoidei Obliqui.

The Arytenoidei Obliqui extend from the base of one of the Arytenoid Cartilages to the point of the other; and the fibres of these muscles decussate each other like the strokes of the letter X. These muscles are subservient to the same purpose as the preceding.

Crico-Arytenoidei Laterales.

These muscles take their origin from the sides of the Cricoid Cartilage, where it is covered by the Thyroid; and they are inserted into the sides of the bases of the Arytenoid Cartilages.

These are the antagonists of the preceding muscles; by their cooperation they separate the Arytenoid Cartilages from each other, and dilate the Glottis.

Of the Thyro-Arytenoidei.

These muscles, which take their rise from the under and back part of the Thyroid Cartilage, run

upwards upon the side of the Glottis, and are inserted into the fore part of the Arytenoid Cartilage.

By these muscles the Arytenoid Cartilages are pulled forwards towards the Thyroid, and the Vocal Chords are shortened.

Of the Crico-Thyroidei.

These muscles arise from the sides and fore parts of the Cricoid Cartilage, and are inserted into the under parts and inferior Cornua of the Thyroid Cartilage.

Crico-Arytenoidei Postici.

These muscles arise from the back part of the Cricoid Cartilage, and are inserted into the narrow extremity of the back part of the base of the Arytenoid Cartilage.

These muscles pull the Arytenoid Cartilages backwards; and, when thrown into action at the same time as the Crico-Thyroid, the Vocal Chords are fully stretched, or made tense.

Sect. IV.

OF THE PHYSIOLOGY OF THE LARYNX.

The limits of these outlines only permit me to add a few observations respecting the Physiology of the Larynx.

The Larynx is composed of elastic Cartilages, each of which is well calculated for vibrating.

The sound of the voice is occasioned by the vibrations to which the air expelled from the Lungs is exposed in passing through the Glottis.

Sounds are grave, or acute and loud, according to the size of the Larynx and of the aperture of the Glottis, and the tension of the Vocal Chords.

That the Larynx is the principal seat of the voice may be proved by a simple experiment. By opening the Windpipe below the Larynx the voice is lost.

It seems probable, that the sound of the voice has some connexion with the capacity of the Larynx: hence the very remarkable difference in the sound of the voice, when the Larynx is raised or depressed, in the different sexes, and at different periods of life. The above observation is applicable to the case of eunuchs, whose tones of voice and Larynx resemble those of the female: hence also the similarity of the voice of infants of both sexes at the period of birth, whose Larynxes are similar in size and form: hence the remarkable distinction between the sound of the voice in the different sexes after puberty, when the Larynx of the male is much expanded.

The human voice has been compared by some authors *to a flute;* by others, to *a chorded instrument.*

The human Larynx is, however, superior to all instruments made by human art.

It is composed of Cartilages, so constructed, disposed, and articulated with each other, as to be susceptible of a great variety of motion; and which are affected by those slighter tremors of the air that do not in the smallest degree influence either a wind or chorded instrument. Besides, the vocal chords which alter and modify the tones of the voice are stretched in very various degrees by the muscles of the Larynx, and are fixed to elastic and flexible Cartilages; whereas the chords of all musical instruments are fixed to substances which possess these properties, so essential to harmony and variety of sound, in a very inferior degree.

CHAPTER II.

OF THE GLANDS CONNECTED WITH THE LARYNX AND TRACHEA.

There are Glands of three different descriptions which are connected with the Larynx and Trachea, viz. Mucous Glands, the Thyroid Gland, and Bronchial or Lymphatic Glands.

Sect. I.

OF THE MUCOUS GLANDS CONNECTED WITH THE LARYNX.

On the side of the Epiglottis, next the Larynx, the orifices of a number of Glands are visible, through which a mucous liquor is discharged.

There is a triangular space filled by cellular substance and small Mucous Glands between the Ligaments, which connect the Epiglottis to the notch of the Thyroid Cartilage, and to the under side of the Os Hyoides, and one which fixes the base of the Os Hyoides.

Sect. II.

OF THE MUCOUS GLANDS OF THE TRACHEA.

There are a great many small Mucous Glands which are situated in the posterior part of the Trachea, and also between the Cartilaginous rings of that tube.

SECT. III.

OF THE THYROID GLAND.

THE Thyroid Gland is situated immediately beneath the Larynx, upon the Trachea, and covered by the Sterno-Thyroid, Sterno-Hyoid, and Omohyoid Muscles.

This Gland varies in size in different individuals. It is composed of two distinct lobes, generally united by a small transverse flat band, the thickness of which is very various.

This Gland is covered by a condensed cellular sheath, within which there is in some cases a muscle, called by HALLER the *Levator Glandulæ Thyroideæ*, and by SOEMMERING, the *Musculus Glandulæ Thyroideæ*.

The above muscle takes its rise from the base of the Os Hyoides; and its fibres are expanded upon the Thyroid Gland, and by its action may tend to elevate this Gland.

This is a conglomerate gland, the larger Lobes of which consist of smaller Lobules.

This Gland receives its Blood by four large Arteries, which are derived from the external Carotid and Subclavian Arteries; the corresponding Veins, which are also of large size, terminate in the Jugular and Subclavian Veins.

Of the Physiology of the Thyroid Gland.

A great many opinions have been entertained respecting the use of this Gland, which the reader will find enumerated in the works of HALLER and SOEMMERING.

It must be acknowledged that we are still much in the dark as to the use of this Gland.

SECT. IV.

OF THE BRONCHIAL GLANDS.

AT the division of the Trachea into its two great branches, there is a number of Glands of a dark purple colour, commonly called *Bronchial*, formerly supposed to secrete the dark mucus which is expectorated, but which my FATHER has proved to belong to the Lymphatic System.

PART XIV.

OF THE ORGANIC DERANGEMENTS OF THE LARYNX ARD TRACHEA.

SECT. I.

INFLAMMATION OF THE MUCOUS MEMBRANE OF THE TRACHEA.

THE Mucous Membrane of the Trachea is very susceptible of inflammation, which is either Acute or Chronic. The latter being the more frequent, first claims our attention.

A chronic inflammation of the Mucous Membrane, the Larynx, and Trachea, is sometimes the consequence of severe and repeated Catarrh, especially in persons far advanced in life.

The Secretion from the Glands is very much increased, and therefore Mucus accumulates within the Trachea; this obliges the patient, in order to get rid of the oppression at his Chest, and difficulty of breathing, most severe in the morning, to cough repeatedly; and when the patient is far advanced in life, with such violence

as to impede the free return of venous blood from the Head ; and to induce a temporary suspension of the vital faculties. The Mucus ejected by coughing is generally of a greenish colour, and frothy, from being mixed with a quantity of air.

The preternatural secretion and collection of mucus within the Windpipe, gives rise to a slight degree of difficult breathing, hoarseness, and soreness, both in the Chest and along the course of the Windpipe. In such circumstances, the inner membrane of the Windpipe assumes a slight red colour, from its smaller vessels being tinged with blood, which gives an appearance of great vascularity.

I shall next describe the acute inflammation of the internal membrane of the Larynx, which is observed in those who have been cut off by the disease which in this country has commonly been called the Croup, or the Angina Polyposa of MICHAELIS, Cynanche Trachealis of CULLEN, Cynanche Stridula of CRAWFORD, Suffocatio Stridula of HOME, Cynanche Laryngea of ELLER, and Angina Inflammatoria Infantum of RUSSELL.

In the Larynx and Windpipe of children who have died from the Croup, the internal membrane is found to be redder, thicker, and commonly more soft and spongy, than in its natural state.

The openings of the Glandular follicles are also more apparent.

There is likewise, on many occasions, the ap-

pearance of a preternatural membrane; which, when the Trachea is opened, is of a light green colour; and by exposure to air, changes to a dirty yellow, and becomes white when put into spirits.

The surface of this membrane has a shining appearance, and is covered by a quantity of mucus.

This membrane is of various degrees of thickness, of different consistence, and of greater or less extent in different instances.

I have remarked also, that it is more or less thick in different parts of the Larynx and Trachea; the superior, or upper part, is generally the thickest within the Larynx; and has often a rough and corrugated surface; whilst the surface of other parts of the membrane is quite smooth.

This inflammatory exudation, being on some occasions very tenacious, may be extracted in the form of a tube, retaining the impression of the inner membrane and cartilages of the Trachea.

Sometimes it is as thin as paper, and breaks into pieces when slightly touched; sometimes, instead of a membrane, the inner surfaces of the Larynx and Trachea are covered by purulent matter.

The preternatural membrane is sometimes soft, pulpy, and perforated by a number of small holes, which probably are formed by the flow of mucus from the mucous ducts.

The diseased membrane is most generally found

where the Windpipe divides into its two great branches; it sometimes lines not only the Windpipe, but also the smaller branches, and sometimes extends into the Cells of the Lungs.

The coagulable lymph, in some cases, forms a tube within the trunk of the Windpipe, though in many of the smaller branches it is solid, and consequently the air does not reach every part of the Lungs.

A similar membrane is sometimes found within the Larynx of those who have died of Scarlet Fever; and something analogous to it has been at times ejected from the Bronchi of phthisical patients.

This coagulable lymph is not vascular, and adheres but slightly to the internal Coat of the Windpipe, a quantity of puriform matter being interposed between them.

The inflammation, in many cases, is not limited to the internal membrane: It also extends to those muscles which are external to the Larynx and Trachea; is attended by swelling of the Muscles lying over the Larynx; and hence the Larynx attains externally a rounded figure.

I have also remarked in a few cases, that the Cartilages of the Trachea, when divided, do not appear of the natural whiteness, but are of a deep purple colour.

The mucous Glands, at the back part of the Trachea, are generally enlarged.

The inflammation sometimes extends down the Pharynx, and also into the Oesophagus, which I have observed covered by a thin layer of Lymph. The Lymphatic Glands of the Neck are sometimes swollen in consequence of Croup, and also in the Cynanche Maligna. The internal membrane of the smaller tubes of the Trachea has been found in a state similar to the membrane of the Larynx or Trachea, in those who have died from Measles or Peripneumony.

Of Thickening of the Cartilages of the Larynx.

I have seen in some cases the Arytenoid and Thyroid Cartilages of the Larynx thickened, and covered by a Scirrhous substance, by which the Glottis was straitened.

Of Ossification of the Cartilages of the Larynx and Trachea.

The Cartilages of the Larynx, especially the Thyroid, and sometimes even those of the Trachea are found ossified. In examining the body of an old man, who had for the last six years of his life been subject to a severe and almost unremitting cough, I found the Cartilages of the Larynx and Trachea ossified; a considerable quantity of viscid mucus within the Trachea; and its internal coat thickened, spongy, and red. In such cases, the mobility of the different compo-

nent parts of the Larynx being lessened or destroyed, the voice becomes much feebler: And there have been instances, as I have been informed by my FATHER, of these morbid ossifications exfoliating internally, and portions of the bony matter expelled by coughing.

Of Ulceration of the Inner Membrane of the Larynx and Trachea.

This membrane, as has been already observed, is very subject to inflammation, and sometimes to ulceration, especially in persons of a scrofulous habit, or in such as have been long affected with the Lues Venerea; these ulcerations are most commonly found in the Sacculi Laryngis.

There is a preparation in the Edinburgh Museum, of a portion of the Larynx and Trachea, in which the internal membrane was thickened and ulcerated. This was taken from the body of a woman who died suddenly in a fit of coughing, after having gone through a mercurial course for a Lues Venerea.

Ulcers likewise are formed in the Trachea, in consequence of the Cynanche Maligna; and are at times observed in consequence of abscess, or ulceration of neighbouring or contiguous parts. Thus I have known an abscess, which began in the Oesophagus, penetrate into the Trachea, and suffocate the patient.

Tumours sometimes grow from the posterior part of the Cartilages of the Larynx, and press upon the Rima Glottidis; and these tumours sometimes suppurate internally.

Of Extraneous Bodies lodged within the Windpipe.

Extraneous bodies, as orange seeds, pieces of nutshell, or bone, lodging within the Larynx or Windpipe, give rise to constant cough, and to the expectoration of a great deal of mucus, occasionally mixed with pus. They have sometimes passed into the Trachea, and have proved a cause of sudden death.

Portions of bone remaining in the Trachea may probably also cause ulceration.

Polypi in the Trachea.

The above epithet is perhaps more applicable to the Polypi of the Trachea, than to similar tumours, growing from any other mucous membrane, because there are a number of Ramifications connected to these, which are contained in the branches of the Windpipe.

This kind of substance, when minutely examined, is found to be merely an inflammatory exuda-

tion, sometimes only lining the larger branches of the Windpipe, and therefore hollow, though on other occasions, perfectly solid, when contained within the smaller ramifications of the Bronchi.

Of Calcareous Substances in the Trachea.

These Calcareous substances are commonly found in the smaller branches of the Trachea, and seldom attain a larger size than a pea.

A case, however, was sent to me by Mr A. Burns of Glasgow, with nine of the calcareous substances found in the Trachea, which is an exception to the above observation; for, besides twelve or fourteen small concretions found in the Windpipe, about the size of dried beans, there was one of an oblong figure, and of the size of an olive, situated at the division of the Trachea into its two large branches.

It may not be improper to add, that the patient was extremely deformed in consequence of the Rickets.

In page 407, the chemical analysis of one of these substances by Mr John Davy, is given.

SECT. II.

OF THE DISEASES OF THOSE PARTS WHICH ARE CONNECTED WITH THE LARYNX AND WINDPIPE.

Of Bronchocele, or Goitre.

BY this term is commonly understood an enlargement of the Thyroid Gland, or a tumour connected with the Thyroid Gland. A Bronchocele commonly is an indolent and circumscribed tumour, which increases slowly, does not readily advance to suppuration, and is not attended with pain, or discolouration of the skin.

This disease is frequent in the vallies of the Alps, where it may justly be said to be endemic. This disease also occurs in Britain, and is most prevalent in Derbyshire.

The tumour frequently resembles the shape of the Gland itself, being divided into two parts; but more commonly one side is much more swelled than the other.

The diseased Gland, when divided, is generally found to be composed of a number of small cells, which are filled up by a gelatinous fluid;

in other cases there are only two or three large cells in the Gland, which are filled by blood.

The Thyroid Gland sometimes attains an unnatural size from inflammation. This is followed by ulceration, and the ulcer bears a strong resemblance to a scrofulous sore.

I have also seen two cases of Ossification of the Thyroid Gland.

The Thyroid Gland sometimes becomes dropsical; and this dropsy is sometimes combined with Bronchocele.

The Thyroid Gland has, though much more rarely, been found in a scirrhous state, in persons advanced in life, and also in a state of Fungus Hæmatodes.

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